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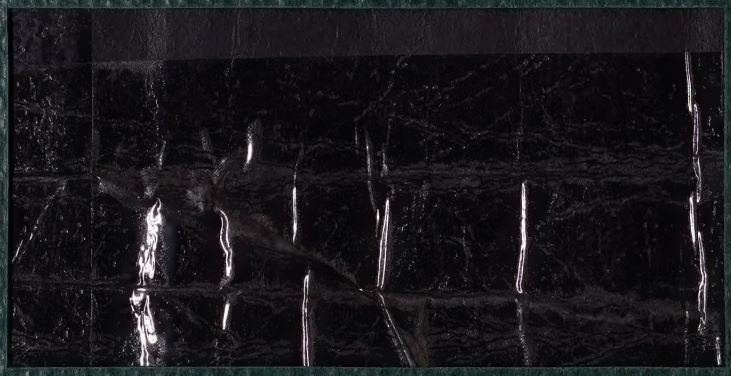

OPERATING MANUAL FOR
PANORAMIC SPECTRUM ANALYZER
MODEL SPA-1

Serial No. 21B106

PANORAMIC RADIO PRODUCTS, INC.

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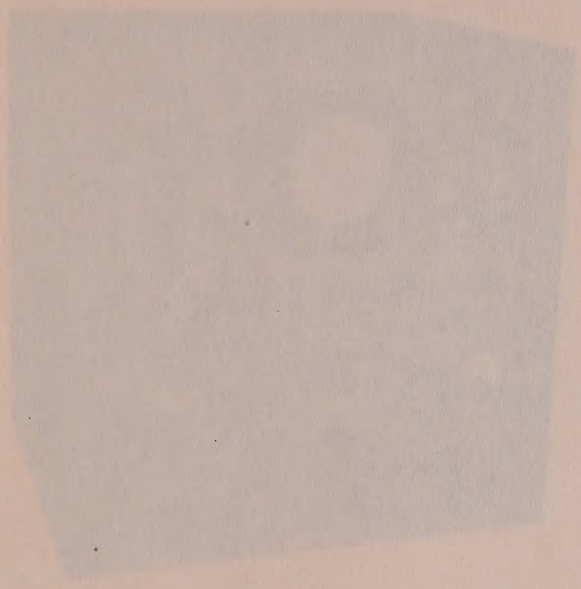
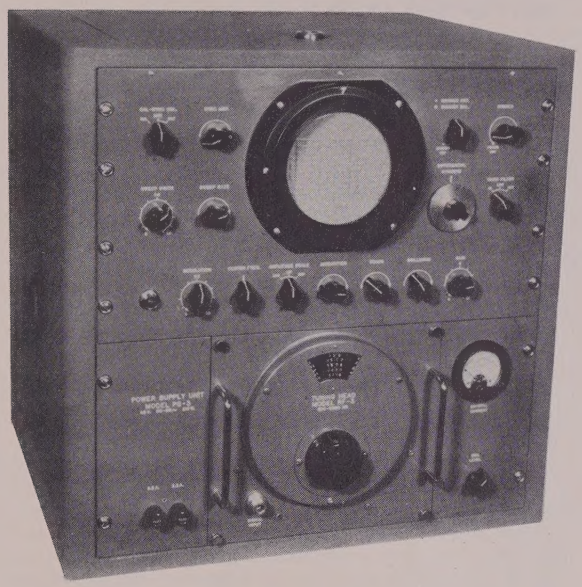


PANORAMIC RADIO PRODUCTS, INC.

PANORAMIC SPECTRUM ANALYZER MODEL SPA-1

A CONVENIENT SINGLE PACKAGE VHF TO MICROWAVE SPECTRUM ANALYZER

50 MC TO 4000 MC WITH TWO INTERCHANGEABLE RF TUNING HEADS



FEATURES

1. Direct reading frequency dial accurate to 1%. Vernier control for ease in resetting.
2. Basic Panoramic analyzer with low frequency swept oscillator of high inherent stability.
3. DC heaters and negative hum feed back on oscillator and reactor tubes insure freedom from hum modulation.
4. Sweepwidth continuously adjustable from 10 MC to zero.
5. Scanning rate continuously variable from 1 to 60 cps. with provision for line or external synchronization.
6. Resolution (adjacent frequency component separability) continuously adjustable from 100 KC to 9 KC.
7. Differential markers and center frequency marker to accurately measure frequency dispersion.
8. Three calibrated amplitude scalas; linear, two decade logarithmic, and square law.
9. High sensitivity with low internal noise.
10. Metered crystal mixer to prevent burn-out.
11. Intensity modulation for fast pulse displays.
12. Large 5" cathode ray tube.
13. Optional camera mount bezel with side-illuminated flat-faced 5ADP7 cathode ray tube.
14. Video filter with selected time constants with front panel switch.
15. Flyback blanking.
16. High-voltage supply for high brilliance, sharp definition.
17. Astigmatism control
18. DC coupled video amplifier for CW analysis.
19. Sturdy construction.

DESCRIPTION

The Panoramic Model SPA-1 is a new high frequency spectrum analyzer which combines unparalleled utility with low cost. Its analyzer section is basically an improved version of the well accepted Model SB-8a T-10,000 Panalyzor with a five inch cathode ray tube. The Panoramic Model SPA-1 also includes a precise direct reading tuning head, a wide-band crystal mixer (metered to avert overload), and power supply. The analyzer's frequency range is thereby extended without the necessity for adjunct heterdoyne instruments. Two interchangeable tuning heads are currently available. The RF-2 is designed for analysis in the bands between 50 and 250 MC. For higher frequency work, between 220 and 4000 MC, the RF-3 is employed. Above 4000 MC, the RF-3 is usable at reduced sensitivity and and without calibration. The selected tuning head frequency precisely reads in megacycles/sec. the center of the band which is being repeatedly scanned by the Panoramic spectrum analyzer. Sweepwidth is continuously variable from ±5 MC. to zero and may be determined quantitatively by means of the internal differential markers from ±50 KC. to ±5 MC. Either wideband observation of a spectrum as large as 10 MC. or very high resolution analysis of small sections is readily accomplished. The frequency components of the input signal appear dispersed along the linearly calibrated horizontal scale of the CRT screen as inverted "V" shaped pips. Their respective amplitudes may be measured by reading the pip heights along any of the three vertical scales, linear 20 db, logarithmic 40 db, or the expanded 10 db. square law scale. The latter is convenient for such uses as power points (half scale deflection- half power) location in pulsed r.f. and critical comparisons between signals or sidebands of similar amplitudes.

When used in conjunction with the optional Panoramic Model DA-1 preamplifier, the Model SPA-1, with the 50 to 250 MC tuning head, RF-2, will display an input signal as small as -100 dbm. full scale with a signal to internal noise deflection ratio of 2 to 1. The sensitivity is the same from 220 to 950 MC with the RF-3 head. At the higher frequencies the comparable sensitivity is somewhat less. Complete data is given under Specifications. Input impedance is 50 ohms. Any 50 ohm calibrated attenuator with adequate frequency response may be employed ahead of the Model SPA-1 input. The continuous Gain control provides attenuation after the crystal mixer from 0 to approximately 40 db.

Among the unique designs of the Panoramic circuitry are the provisions for variable resolution and scanning rates. Any rate from 1 to 60 sweeps per sec. may be selected in free running mode or with synchronization by line or external source. This provision is employed to obtain stationary displays with a very wide range of pulse repetition freq-

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Features Continued

20. Very small "down time" for servicing.
21. Operable by non-technical personnel.
22. Low initial cost.

APPLICATIONS

1. Visual sideband analysis of AM, FM, or pulsed signals with components set for optimum resolution.

2. Energy distributions directly readable on square law amplitude scale. Nulls and power points accurately determined with frequency deviation markers.

3. Rapid means for finding parasitic oscillations, unwanted modulations, hum and noise effects on transmission systems.

4. Visual indication of frequency instability under shock, non-linear modulations, varying loads, etc.

5. Pulse spike "dropouts" seen with easily synchronized stationary displays.

6. Harmonic radiation measurements.

7. Noise spectra.

quencies thus showing the time analysis in addition to the spectrum distribution. Pulse skipping is immediately apparent. When analyzing signals with closely spaced sidebands, the lower scan rates are used to take full advantage of the resolving capabilities of the variable i.f. filter. At its most selective setting, the i.f. will separate signals 9 KC apart. The Resolution control may be adjusted for optimum visual separation once the sweepwidth and scan rate are selected for a particular measurement.

The standard indicator provided with the Panoramic Model SPA -1 is the high-persistence Type 5UP-7 but any other requested phosphor will be furnished. The Model SPA-1 also is available with a camera mount bezel, flat-screen Type 5ADP-7 (or other phosphor) cathode-ray tube and side illumination. Standard 5" oscillograph camera hoods are conveniently attachable to this bezel.

USES

The Panoramic visual display is unsurpassed for analysis of AM, FM, and pulsed systems, crowded communications channels, instabilities of oscillators, noise spectra, and other dynamic phenomena. Non-professional personnel in laboratory or factory can easily use the Panoramic Model SPA-1 once the norms for an application are established. Its versatility permits selection of center frequency, sweepwidth, scan rate, resolution, and type of amplitude indication. Varying conditions, due to changing loads, carrier shifts, mechanical shocks, etc. are instantly noted in both direction and magnitude. The wide frequency range covered aids in studies of harmonic outputs.

Frequency modulated signals are seen as a carrier flanked by the Bessel function sidebands. FM static deviations may be calculated by noting the zero amplitude levels of either the carrier or adjacent sidebands. Modulated signal displays are useful to measure energy distributions and to look for such effects as unwanted or excessive modulations, linearity of deviations, hum and noise, and otherwise undetectable parasitic oscillations.

The variable resolution and scanning rate of the Panoramic Model SPA-1 are especially suited to pulsed radio frequency analysis as in radar systems. The rate is usually adjusted so that a fairly large number of distinct spikes appear on each scan. The 1 per second feature permits good visual description of low prf. dispersions. Where necessary, synchronization may be used to assure a repetetive pattern. With narrow pulses, the power points and nulls are relatively far apart in the spectrum and the i.f. selectivity is usually reduced with resolution control to assure adequate amplitude response. An intensifier is included to brighten pulse displays.

DESIGN FEATURES

Input signals to the Panoramic Model SPA-1 are heterodyned in a broad-band crystal mixer by beating with the output of the butterfly tuning head oscillator. Both the RF-2 and RF-3 heads have large calibrated dials with multi-turn slow motion drives for easy resettability. Their scales read 30 MC from the oscillator frequencies to account for the translation to the input center of the analyzer section. Thus, the heads are calibrated directly in center frequency of the band analyzed. The RF-2 has a continuously calibrated scale reading from 50 to 250 MC. In higher frequency measurements with the RF-3, the oscillator's fundamental and harmonics are calibrated in five over-lapping ranges from 220 to 4000 MC. Higher harmonics may be used to heterodyne signals above 4000 MC. down to the 30 MC. range for analysis. However, there may be resonant "suckouts" in the mixer and coupling networks that can result in irregular sensitivity changes with frequency. The converter contains a Type IN21-B silicon diode and an output low pass filter to attenuate frequencies above 40 MC. Those heterodyne products which fall in the 25 to 35 MC band are passed by the analyzer section's input filter. This filter's bandpass selectivity further discriminates against unwanted products of the input conversion. The signals are then amplified and beat with the analyzer's swept local oscillator in a 6J6 mixer stage. The swept oscillator is frequency modulated by a sawtooth driven reactance tube state as set by the sweepwidth control. It is a highly stable push-pull design with twin 6J4 triodes. An ingenious feedback network using a 12AU6 simultaneously counter-acts variation in oscillator amplitude and random frequency modulation. In the course of its frequency excursions, the oscillator successively beats with each of the signals present in the converter, producing a series of signals of the proper intermediate frequency to be amplified in the sharply tuned i.f. states. The selectivity of the i.f. is controlled by changing the loading in a dual "Q" multiplier. These successive i.f. pulses, separated from each other by time, are then fed to a diode detector and applied to the vertical plates of the cathode ray tube through a DC coupled video amplifier. A logarithmic feedback compressor and a diode's v-i curve are used for the 40 db. log and 10 db. square law scales respectively. The DC coupling permits examination

of CW on very small sweepwidths, a Capacitive video filter serves to eliminate annoying irregularities in pip shapes in displays of closely spaced signals.

There are two intermiediate frequencies in the Model SPA-1. The first is 23 MC. chosen specifically to attenuate spurious pips which result from any lower first i.f. because of harmonics of the swept oscillator and input signals beating in the mixer. After another conversion, the signal pips are passed through a 500 KC i.f. filter in which the necessary selectivity is introduced.

A phantastron oscillator provides the push-pull linear sawtooth for the horizontal sweep on the indicator tube. Its period is changable with the Rate control from 1 to 60 cps with no time lag after resetting. The waveform which modulate the oscillator's reactor is also derived from the horizontal sweep generator. Thus, the horizontal axis of the screen display is a frequency scale. It is calibrated in deviation about the center frequency which is indicated on the tuning head dial to a tolerance of ±1%. A precision wavemeter may be employed for more accurate frequency determinations. The differential sweepwidth markers consist of two high capacitance Hartley oscillators which are simultaneously tuned by the dual air-trimmer condenser such that their second harmonic frequencies are equally spaced above and below from the 30 MC. input center of the analyzer section. The front panel marker dial reads this second harmonic frequency difference which serves as a calibration for the sweepwidth control. A convenient by-product of this circuit is that the sum of the fundamentals is always 30 MC. When the markers are used, the horizontal positioning of the input center is also checked by the sum frequency pip.

A doubler high-voltage supply and retrace blanking are among the design features of the Panoramic Model SPA-1. The display intensity, focus, and astigmatism are simply adjustable for a clear well-defined trace.

The comparatively low frequency range of the analyzer section lends itself to high inherent stability of the swept oscillator. The oscillator circuitry contains miniature low-power tubes so that a small selenium rectifier is adequate for the DC heater supply. This provision insures freedom from the common annoyance of hum modulation on the signal displays. This type of construction, components, and wiring is sturdy and trouble-free as well as relatively inexpensive.

SPECIFICATIONS

Analyzer and Indicator Sections (Model SC-8b, T10,000)

Sweepwidth: 10 MC. (3 MC/inch) continuously reducible to zero

Input Center Frequency: 30 MC

Bandpass Range of Analyzer: 25 MC to 35 MC

Bandpass Amplitude Flatness: ±1 1/2 DB

Direct Sensitivity: 75 microvolts, full scale linear deflection

Resolution: (Frequency separation of two signals of equal amplitudes, the deflections of which intersect 0.5 down from their peak amplitudes) Continuously variable from 9 KC to 100 KC

Spurious Response: No signal exclusive of images of a frequency above the bandpass and less than 0.1 volt produces a deflection greater then: $\frac{1}{4}$"

Image Rejection Ratio at Input Center Frequency: Better than 250:1.

Sweep Rate: continuously variable from 1 to 60 cps. synchronized to power line frequency or external: or free-running.

External Synch. Amplitude: 1 volt (min.)

Amplitude Scales:

a) 20 db. linear
b) 40 db. logarithmic
c) 10 db. square law

Sweep Width Markers: continuously variable from ±50 KC. to ±5 MC

Cathode Ray Tube Options:

1) 5UP-7
or 2) 5ADP-7 with edge lit reticule camera mount bezel flange.

Other phosphor indicator screens available upon request.

Overall Specifications

Input Impedance: 50 ohms

Sensitivity: Sensitivity limited by noise and defined as amplitudes for which signal to noise deflection ratio is 2 to 1 at Resolution of 10 KC., (With the Model SPA-1 preamplifier)

Tuning head RF-2,	50 to 250 MC.	-100 dbm.
Tuning head RF-3,	220 to 950 MC.	-100 dbm.
	470 to 1870 MC. ±	- 94 dbm.
	720 to 2790 MC. ±	- 88 dbm.
	970 to 3710 MC. ±	- 82 dbm.
	1220 to 4000 MC. ±	- 76 dbm.

Without Model PRA-1 preamplifier: Sensitivity defined as minimum signal amplitude for one devision linear deflection $\frac{1}{4}$" inasmuch as noise level is below visual sensitivity.

Tuning head RF-2,	50 to 250 MC.	-75 dbm.
Tuning head RF-3,	220 to 950 MC.	-75 dbm.
	470 to 1870 MC. ±	-69 dbm.
	720 to 2790 MC. ±	-63 dbm.
	970 to 3170 MC. ±	-57 dbm.
	1220 to 4000 MC. ±	-51 dbm.

± These scales employ harmonics of the RF-3 oscillator.

Noise level: With Model PRA-1 preamplifier, less than 0.5 microvolts across 50 ohms when analyzer resolution is set at 10 KC.

Overall Flatness with PRA-1: ±1 db

Tuning Head Controls

Tuning: Calibrated dial reading center frequency of analyzed band.

Oscillator Level: Smooth adjustment for optimum mixing and to prevent overload in mixer as monitored on meter dial.

Analyzer Section Controls

Sweep Width: Smooth adjustment of dispersion from 0 to ±5 MC.

Sweep Rate: Smooth adjustment of rate from 1 to 60 cps.

Cal. Synch. Selector: 3 pos. switch.

Line: Time base synchronized to power line
External: auxiliary synch.
Cal: Power line frequency on vertical deflection plates to calibrate sweep rate dial with lissajou figures.

Synch. Amplitude: Adjusted upwards until stable pattern is seen. When set at min. level sweep is free running.

Amplitude Scale: 3 pos. switch selects vertical amplitude scales, Log, Linear or Exponential (square law)

Gain: Smooth signal level adjustment, 0 to approx. 40 db.

Video Filter: 3 pos. switch, High, Low or Out

Resolution: Smooth adjustment of selectivity of i.f. for optimum adjacent signal separability

Center Freq.: Vernier control of swept local oscillator center frequency

Differential Markers: Calibrated dial reading sweep-width between twin markers from 100 KC. to 10 MC.

Marker Balance & Marker Amplitude: Concentric potentiometer to adjust markers for equal amplitudes and to control their common amplitude. Min. position of Amplitude contains marker on-off switch.

Brilliance & Focus: Adjustments for proper trace sharpness and intensity

Intensifier: Brightens trace of rapid pulsed signals

Power Switch: On-Off interconnected to power supply

Illumination: With camera mount bezel option, controls edge lighting of flat-faced screen.

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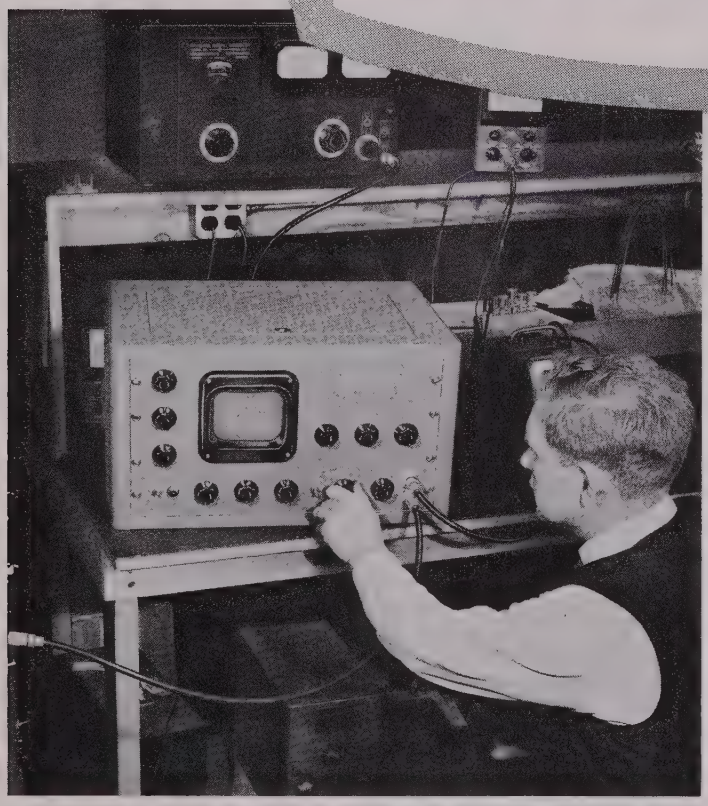
the pioneer
is the leader

SB-8a
SA-8a

PANORAMIC
PANALYZOR SB-8a
PANADAPTOR SA-8a



Model SB-8a Type T-10,000 being used to examine frequency modulated UHF generator.

FEATURES

- Continuously variable resolution
- Continuously variable scanning width
- Long persistence cathode-ray tube 5" Screen
- Intensity grid modulation for pulse analysis
- Synchronous and non-synchronous scanning
- Variable scanning rates
- Signal amplitude compression

ADVANTAGES

- Provides visual spectograph of radio frequencies
- Long or short persistence panoramic displays
- Shows instantaneous changes in signal frequencies and amplitudes
- Identifies signals and displays their characteristics
- Quick, easy interpretations
- Simple operation

USES

- Investigating pulsed R.F. signals
- Analyzing AM and FM transmitters
- Testing industrial R.F. equipment
- Spotting spurious oscillations and modulation
- Monitoring communications bands especially for signals very closely adjacent in frequency
- Checking diathermy and electro-surgical instruments
- Telemetering
- Calibrating FM sources for deviation

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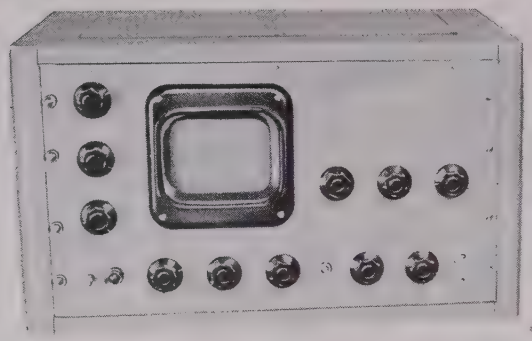
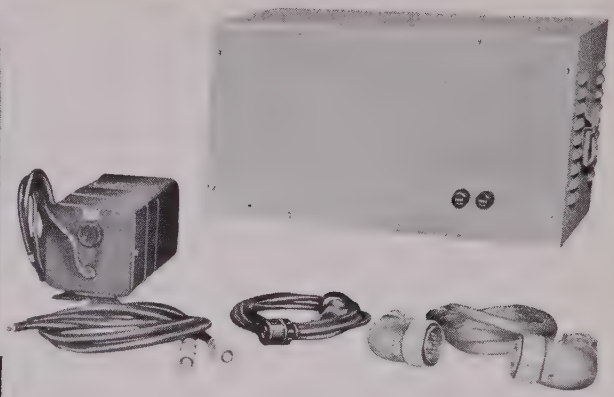
PANORAMIC **PANALYZOR SB-8a, PANADAPTOR SA-8a**





UNIQUE FEATURES ASSURE CRITICAL, HIGH SPEED SPECTRUM ANALYSIS OF RF, VHF, UHF AND MICROWAVES.

Both the Panalyzor and Panadaptor are automatic scanning superheterodyne receivers which permit analysis and identification of one or many R.F. signals at one time. Each signal, according to its nature, is depicted on a cathode ray tube as one or a series of inverted Vs or pips whose amplitude and position along a calibrated horizontal axis are indicative of level and frequency, respectively. A CW signal produces a single pip. Modulated signals (AM, FM or pulsed) cause a series of pips indicating side band distribution and level.

These instruments provide the utmost in simplicity for observing such things as the effects of power supply fluctuations, thermal changes, humidity, component variations, shock, vibration and load changes upon frequency. Both magnitude and direction of frequency drift are indicated. Parasitic oscillations which normally may pass unnoticed can quickly be detected and identified. Spurious modulation by supersonics, hum and noise are readily spotted.

Because of their panoramic presentations both instruments are invaluable for monitoring a frequency band for the appearance, disappearance and shift of signals. Highly useful graphic displays of such things as Bessel function distributions of FM signals, energy distribution of pulsed R.F. signals with low p.r.f.'s AM sidebands, etc., can be obtained.

The Type T-10,000 equipments available in the SA-8a and SB-8a are accepted as excellent foundation units for spectrum analysis of microwave bands. Type T-10,000 instruments have a 10 MC scanning width. The SA-8a is commonly operated with search receivers or tuning heads which have provisions for a 30 MC I.F. The SB-8a, on the other hand, is operated with an external oscillator and suitable external mixers to convert the microwave bands down to 30 MC. Further information on the operational characteristics and factors influencing selection of Panadaptor and Panalyzor equipment follows elsewhere.

The SB-8a and SA-8a are unique in that they offer all the advantages of wide scan spectrum presentations, yet enable examination of signals so closely adjacent in frequency that their corresponding deflections normally tend to merge together or even completely mask one another in wide scan displays.

Three types of instruments, available in these models, having maximum scanning widths, of 200 KC, 1 MC and 10 MC, can at reduced sweepwidths, respectively resolve signals separated by 50 c.p.s., 400 c.p.s. and 9 KC.

CONTINUOUSLY VARIABLE SCANNING AND RESOLUTION CONTROLS ENABLE OPTIMUM RESOLUTION

Resolution, or the ability to separate individual signals, is dependent upon two factors: the rate of frequency scan and the I.F. bandwidth of the instrument. Optimum resolution obtains when a definite relationship exists between the two. Resolution sharpens as both scanning rate and I.F. bandwidth decrease. The scanning rate can be diminished by increasing the scanning period or conversely by decreasing the spectrum width scanned within a given time. The SB-8a and SA-8a employ both methods for highly flexible operations.

Front panel controls allow selection of line synchronized scanning rates of 5 c.p.s. or 30 c.p.s., plus non-synchronized rates of 1 c.p.s. and 25 to 35 c.p.s. variable. The latter range is extremely useful for analysis of signals modulated by frequencies which are multiples or sub-multiples of the line frequency.

A scaning width control provides continuously variable adjustment of scanning width from maximum to zero.

A continuously variable resolution control is utilized for I.F. bandwidth adjustments.

As the scanning width is progressively decreased the deflections immediately surrounding the center of the screen spread across the screen while those at the outer extremities move off scale. Somewhat improved resolution results. Optimum resolution, however, results when the I.F. bandwidth is properly adjusted with the resolution control. Further improvement obtains when the scanning rate is reduced.

Complete resolution data is contained in the curves on resolution versus scanning width.

INTENSITY GRID MODULATION, LONG PERSISTENCE PRESENTATION FACILITATE PULSE SPECTRUM ANALYSIS

Intensity grid modulation circuits, designed to accommodate the high writing speeds associated with pulsed signals, are incorporated to provide brilliant pulse spectrum displays. A front panel control allows adjustment of the modulation potential amplitude applied to the c-r tube intensity grid.

A long persistence c-r tube screen offers the unique advantage of enabling a continuous overall presentation of energy distribution of pulsed signals with low p.r.f.'s. Normally such signals cause pulsed deflections to move across the screen either slowly or rapidly, simultaneously describing the energy pattern. The long persistence screen "captures" and retains the pattern in the form of a sharply defined afterglow.

PANADAPTOR SPECIAL FEATURES

(a) PANADAPTOR units operate in conjunction with receivers having an I.F. equal to the PANADAPTOR input frequency. (Refer to specifications.) Interconnection is made at the output of the receiver converter. By receiver action observation of local or remote signals is possible.

(b) Total frequency coverage is equal to the range of the receiver.

(c) Center deflection corresponds to the signal to which the receiver is tuned.

(d) Flatness of amplitude response is the product of receiver selectivity, at the output of the converter, and the fixed bandpass characteristic of the PANADAPTOR. Inasmuch as receiver selectivity will vary not only

ERRATA AND ADDENDA

1. In PANALYZOR SPECIAL FEATURES paragraph (a), add to last sentence, "When the spectrum of interests falls within the Input Center Frequency $\pm$ one-half the maximum sweep width, only one input need be employed. The Panalyzor response will then be as described under "Direct Sensitivity" in the Specifications chart. When an external tuning head is available to convert the test signals to the Input Center Frequency region of the Panalyzor, the single input is similarly adequate."

2. In PANALYZOR SPECIAL FEATURES paragraph (b), add "The input mixer is usable up to approximately 1000 mc. For higher frequency spectrum analysis, it is advisable to heterodyne externally with a crystal mixer."

3. In SPECIFICATION CHART PANALYZOR, Tube Size should be shown as "5" CRT".

SUPPLEMENTARY DATA

Now in production, the NEW Panoramic SB-8b Panalyzors and SA-8b Panadaptors incorporating important design improvements and additional features. The SB-8b and SA-8b models supercede the widely accepted SB-8a and SA-8a. Advanced Panoramic engineering has now made available these even more versatile instruments for r.f., u.h.f., and microwave spectrum analysis.

The extensive microwave applications of the Type T10,000 with 10 mc. maximum sweep width, has led to the development of a new instrument, the Model SC-8b, T10,000 Panoramic Indicator. Refer to the chart in this addenda for the criteria for choosing among the three T10,000 models.

Specifications for the SB-8a and SA-8a units are applicable to the "b" series with the exception of those for SWEEP RATE. On all SA-8b, SB-8b and SC-8b models, the SWEEP RATE is variable continuously from 1 to 60 cps., free running, line or external synchronized. The pertinent Resolution's may be found by interpolation on the graphs for the older equipments. The additional specifications for the new features are described herein.

Major revisions incorporated in all the SA-8b, SB-8b, and SC-8b are as follows:

1. New Scanning Rate circuitry. The rate is continuously variable from 1 thru 60 scans/sec. free running, with provision for line and external synchronization. A calibrating line frequency wave is impressed upon the vertical deflection plates when a line synchronized rate is to be determined directly.

Pulsed r.f. analysis is particularly convenient with the new time base circuitry. Stationary displays with a very wide range of p.r.f.'s are obtainable thus permitting observations both in the frequency and time domains. "Spike dropouts" are instantaneously noted.

2. New square law EXPonential vertical deflection scale for more precise determinations of power points, side band energies, etc. The EXP. display is in addition to the LIN and compressed 40 db. LOG amplitude scale. On EXP., the relative deflections of discrete frequency pips are proportional to the squares of their amplitudes or directly as power.

3. Facilities for photographic records of the Panoramic analysis. A flat screen cathode-ray-tube (Type 5ADP7) with standard camera-mount bezel flange and adjustable scale illumination, is available. A voltage doubler is included with the camera-mount option. It supplies 4 KV acceleration potential to take advantage of the highly improved focusing qualities of the 5ADP-7. This option is indicated by adding "Z" to the model designation, e.g. SB-8b, T200-Z.

4. Improved input stage GAIN control dynamic range (max/min signal for full scale deflection) with cascode and cathodyne rf stage amplifiers.

On all three Type T10,000 models, differential marker circuitry is supplied, if desired. The markers are two pips equidistant from the center frequency of the analyzed spectrum which serve to calibrate the sweep width control by enabling the frequency separation between signals to be read. The marker separation is adjusted by a control with a calibrated dial and is usable with sweep widths from 0.1 to 10 mc. The marker option may be indicated by adding "M" to the model designation, e.g. SA-8b, T10,000-M or for both the camera mount and marker options, SA-8b, T10,000-ZM.

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PANORAMIC INDICATOR MODEL SC-8b, T10,000

The Model SC-8b, T10,000 is similar to the SB-8b, T10,000 except for its input circuitry. The input of the SC-8b contains a cascode amplifier instead of an aperiodic mixer. It is, therefore, considerably more sensitive; i.e., 75 uv. full scale. Its other electrical and physical specifications are identical to those of the SB-8b, T10,000.

The SC-8b, T10,000 in conjunction with suitable signal generator and mixer, provides a sensitive, versatile and low cost spectrum analyzer which is especially convenient at microwave frequencies. For those preferring a single packaged unit, the Panoramic Spectrum Analyzer Model SPA-1 covers the 50 to 4,000 mc. range with only two tuning heads. The Model DA-1 Panoramic Bandpass Amplifier is designed to operate with the T10,000 instruments to increase their usability for weak signals analysis. With the Model DA-1, 1.0 microvolts rms is clearly visible above internal noise at 10 KC resolution. Since noise becomes the limiting factor with the preamplifier, no appreciable difference in overall sensitivity among the SA-8b, SB-8b and SC-8b, T10,000 is obtained. For complete specifications, refer to the literature on the Model DA-1.

CRITERIA FOR SELECTION AMONG THE T10,000 TYPES OF PANORAMIC INDICATORS

Preamplifier to be used	Frequency ranges of interest	Sources of spectrum to be analyzed	Signal Level (of weakest freq.)	Recommendations
None or with Model DA-1	Unrestricted	Receiver with 30 mc. intermediate frequency	Use DA-1 with low gain receivers	Use SA-8b, T10,000 which has 2.5 to 1 flatness compensation for the receiver's selectivity to achieve optimum overall flatness.
None	Up to 1000 mc.	Locally generated (or unselective source)	Greater than 5 mv.	Use SB-8b, T10,000 with input aperiodic mixer. With external generator amplitude of 0.1 volts, a 5 mv. component will be approximately half scale.
None	Up to 1000 mc.	Locally generated (or unselective source)	Greater than 15 mv.	Use SC-8b, T10,000 in conjunction with external mixer and generator. Allowing for a 6 db. conversion loss in the ext. mixer, a 75 uv. component will yield half scale deflection.
None	Above 1000 mc.	Locally generated (or unselective source)	Greater than 15 mv.	Use SC-8b, T10,000 in conjunction with appropriate microwave generator and mixer.
None	r.f. thru microwave	Locally generated (or unselective source)	Greater than 5 mv.	Use SB-8b, T10,000. Up to 1000 mc., the input mixer may be conveniently employed. Above 1000 mc., an external crystal is advisable.
None	r.f. thru microwave	Locally generated (or unselective source)	Greater than 15 uv.	Use SC-8b, T10,000 with external mixers.
Model DA-1	r.f. thru microwave	Locally generated (or unselective source)	Greater than 1 mv.	Use SB-8b, T10,000. With preamplifier, all T10,000 types are equally useful for down to 1.0 uv. component analysis. SB-8b, T10,000 would be chosen for possible future use of input aperiodic mixer.

from set to set, but also throughout the tuning range, overall flatness of response will not be fixed. Therefore the relative amplitudes of signal deflections distributed across the screen may not correspond with actual relative signal levels.

(e) Presentation of images is mainly a function of the image rejection characteristics of the reeciver. Moreover, images can be identified since, as the receiver is tuned, the image deflections move in a direction opposite to that of regular signals.

PANALYZOR SPECIAL FEATURES

(a) PANALYZOR equipments operate with an external signal generator which is attached to one of two input connectors. The signal or signals to be examined are coupled directly from their source through a coaxial cable to the other input connector.

(b) Range coverage is from 200 mc down to the input center frequency of the PANALYZOR selected. (Refer to specifications).

(c) The signal will cause a centered deflection when the generator is set at a frequency equal to the signal frequency ± the PANALYZOR input center frequency.

(d) Flatness of amplitude response is dependent solely upon the bandpass characteristics of the PANALYZOR and is therefore fixed within the limits indicated in the specifications.

(e) Image presentation is a function of the image rejection characteristics of the PANALYZOR.

USES

The uses detailed below represent but a few of the many applications of PANALYZOR and PANADAPTOR. Inquiries are invited regarding the application of these instruments to particular requirements.

PANALYZOR and PANADAPTOR offer far superior means for examining oscillator performance, especially in the VHF regions where small changes in circuit constants, both physical and electrical, produce large frequency variations. Oscillators can be checked against standards for determining frequency and the effects of load changes, component variations, shock, and humidity and thermal changes upon frequency stability. Parasitic oscillations are easily spotted and identified.

Diathermy units, dielectric and induction heaters, and other industrial R.F. equipments can be easily analyzed and monitored within close tolerances for off-frequency operation by PANALYZOR or PANADAPTOR. Either two separate crystal controlled oscillators or a single modulated crystal oscillator may be used as standards which produce marker pips indicating the permissible frequency limits of operation.

PANADAPTOR equipments are uniquely suited for monitoring communications frequencies at airports and communication centers for possible off-frequency transmissions. The immediate appearance of such signals can be detected instantaneously and tuned to quickly with absolute minimum chances of message loss. High resolution makes the equipment invaluable for detecting and analyzing interference caused by splatter, improper location of carrier frequencies, spurious modulation, parasitics, etc.

Both instruments are invaluable in universities and technical schools for their graphic indications of various R.F. phenomena, making them easy to understand and simple to remember.

Unlike any other instrument the PANALYZOR shows pictorially the static and dynamic operating characteristics of F.M. sources. All components of an F.M. signal, the carrier and its associated sidebands, are instantaneously displayed in terms of frequency and amplitude, enabling analysis of energy distribution, frequency deviation, carrier shift and linearity of modulation. Static deviations may be calculated by noting the zero levels of either the carrier or adjacent sidebands. The exceptionally fine resolution capabilities allows such calculations for signals modulated by audio frequencies as low as 200 c.p.s.

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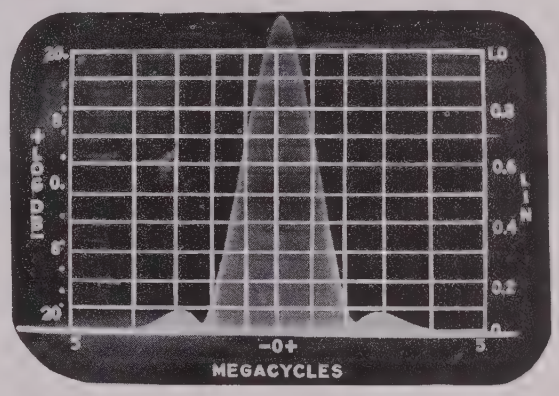
Piezo-electric crystal blanks and crystals in the process of being ground, can be compared against a standard for frequency and activity. Horizontal displacement of the deflection of the test crystal from the standard deflection indicates the direction and magnitude of frequency difference. Small differences in frequency may be made more prominent by reducing the scanning width. Thus tedious frequency checks by heterodyne beating are eliminated.



DESCRIPTION

In many respects the PANALYZOR and PANADAPTOR resemble a highly efficient superheterodyne receiver in operation. The circuits consist of an R.F. amplifier, converter, local sweeping oscillator, I.F. amplifier, detector, video amplifier, cathode ray tube indicator and associated sweep circuits.

The main difference between PANALYZOR and PANADAPTOR lies in the input stage.

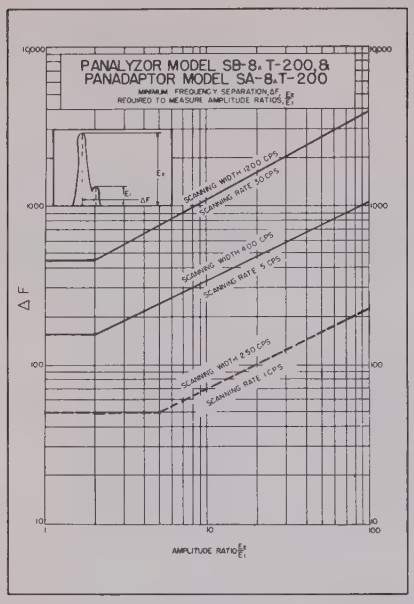
The input of the PANALYZOR is an aperiodic mixer in which the test signals are mixed with the output of the external signal generator. The mixed difference frequencies are then amplified by a bandpass stage, the output voltages of which are applied to a second converter or mixer and are in the same ratio as the original signal strengths.

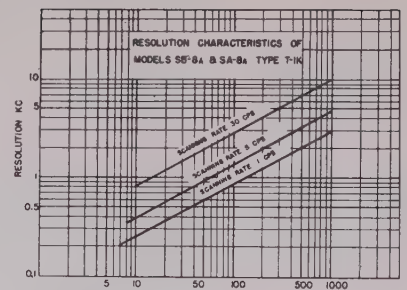
The input stage of the PANADAPTOR is connected through an isolating element to the output of the receiver converter. This stage has bandpass characteristics which compensate for receiver selectivity at the point of connection so as to obtain a relatively flat response at its output which is fed to a converter or mixer.

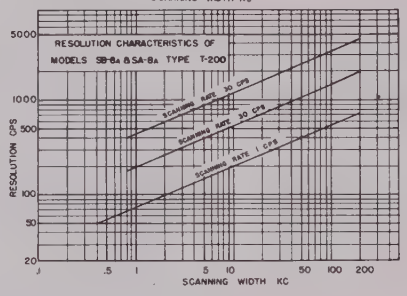
Fed simultaneously to the mixer is a voltage from a local oscillator whose frequency is periodically varied between established limits. In the course of these frequency excursions, the oscillator successively beats with each of the signals present in the converter, producing a series of signals of the proper intermediate frequency to be amplified by a sharply tuned variable selectivity I.F. amplifier which follows. These successive I.F. pulses, separated from each other by time, are then fed to a diode detector and applied to the vertical plates of the cathode ray tube through a DC coupled video amplifier. DC coupling enables examination of carriers for hum, noises, etc.

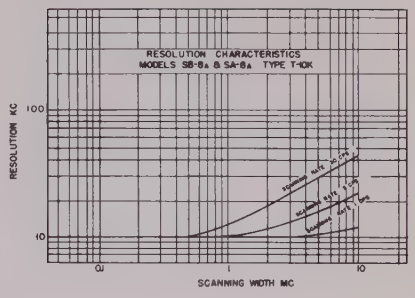
The frequency modulation of the oscillator is produced by the reactance-tube method. Changes in oscillator frequency depend upon the potential applied to the reactor grid. The source of modulating voltage for the reactor grid is a sawtooth oscillator of the blocking-tube variety.

The sawtooth generator performs two functions simultaneously. First, it varies the voltage applied to the grid of the reactor. Second, through an amplifier it sweeps the electron beam of the CRT horizontally across the face of the tube. Since the sawtooth is common, deflections are located horizontally in accordance with signal frequency.


PANALYZOR MODEL SB-8A T-200 &
PANADAPTOR MODEL SA-8A T-200
MINIMUM FREQUENCY SEPARATION ΔF REQUIRED TO MEASURE AMPLITUDE RATIOS E2/E1
SCANNING WIDTH 1200 CPS
SCANNING RATE 30 CPS
SCANNING WIDTH 400 CPS
SCANNING RATE 5 CPS
SCANNING WIDTH 250 CPS
SCANNING RATE 1 CPS
ΔF
AMPLITUDE RATIO E2/E1







SPECIFICATION CHART PANALYZOR MODEL SB-8A

	Types		
	T-200	**T-1,000**	**T-10,000**
Maximum Sweepwidth	200 KC	1000 KC	10 MC
Input Center Frequency	500 KC	5 MC	30 MC
Bandpass Region	400 KC- 600 KC	4.5 MC- 5.5 MC	25 MC- 35 MC
Bandpass Region Characteristic: Flat to	±5%	±7%	±15%
Image Rejection Ratio at input center frequency: Better than	250:1	150:1	100:1
Spurious Response: No signal exclusive of images, of a frequency above the bandpass and less than .1V produces a deflection greater than	¼"	¼"	¼"
Direct Sensitivity: Maximum voltage at center frequency required for full size deflection on linear amptitude scale	100 μV	500 μV	750 μV
Product Sensitivity: Maximum product voltage of external oscillator and test signal required for full scale log	10^{-3} V. — V.	5×10^{-2} V. — V.	10^{-2} V. — V.
Input Impedance	50 ohms	50 ohms	50 ohms
Sweep Rate and Wave Form	5 c.p.s. 30 c.p.s. Synchronized, 1 c.p.s. 25.35 c.p.s. Variable, Sawtooth		
Power Source	115/230 V. 50-60 cycle, single phase.		
Power Consumption (Approx.)	80 Watts	80 Watts	80 Watts
Tube Size	Analyzer Unit: 12¼" high, 22¾" wide, 17" deep overall,		
Dimensions	Analyzer Panel: 10½" standard rack mount. Power Supply: 8¾" high, 15½" wide, 10" deep.		

SPECIFICATIONS CHART PANADAPTOR MODEL SA-8A

	T-200	**T-1000**	**T-10000**
Max. Sweepwidth	200 KC	1 MC	10 MC
Input Center Freq. Range Factory Aligned to	450-470 KC 455 KC	5.25 MC	30 MC
Sensitivity for full scale linear	2,000 μ V	2,000 μ V	150 μ V
Bandpass Characteristic: Amplitude Ratio of Side Peaks to Center Valley	30:1	5:1	2.5:1
Sweep Rate and Wave Form	5 c.p.s. 30 c.p.s. Synchronized, 1 c.p.s. 25.35 c.p.s. Variable, Sawtooth		
Coupled to Receiver through	Res. 50,000 ohm	Res. 25,000 ohm	Cathode Follower in Receiver
R.F. Input Cable	RG-11 μ		
Power Source Req.	115/230V., 50-60 cycle		
Power Consumption	80w.	80w.	80w.
Tube Size	5 "CRT		
Dimensions	Analyzer Unit: 12¼" high, 22¾" wide, 17" deep overall, Analyzer Panel: 10½" standard rack mount. Power Supply: 8¾" high, 15½" wide, 10" deep.		

PANORAMIC
RADIO PRODUCTS, INC.
10 SOUTH SECOND AVENUE, MOUNT VERNON, NEW YORK

COMPOSITE OPERATING MANUAL

OR

PANADAPTOR MODEL SA-8b
TYPE T-10,000

PANALYZOR MODEL SB-8b
TYPE T-10,000

PANORAMIC INDICATOR MODEL SC-8b
TYPE T-10,000

AND

PANORAMIC SPECTRUM ANALYZER
MODEL SPA-1

PANORAMIC RADIO PRODUCTS, INC.

TELEPHONE:
MOUNT VERNON 4-3970

10 SOUTH SECOND AVE.
MOUNT VERNON, N. Y.

CABLE ADDRESS:
PANORAMIC
MT. VERNON (N. Y.)

1. OPERATING CONTROLS

The following controls are at the disposal of the operator. They are mounted on the front panel.

1.1. Analyzer Section Controls

a. CAL-SYNC SEL: This is a three position switch which permits, in the CAL position, calibration of the sweep rate by injecting 60 cycles into the vertical deflection. In the LINE position, the sweep is synchronized with the power line frequency. The EXT position permits sweep synchronism by means of a suitable signal fed to the EXT. SYNC jack on the rear apron of the analyzer section chassis.

b. SYNC AMP.: The amplitude of the sweep synchronizing signal is adjusted with this control to provide for proper c-r t beam sweep synchronism. Maximum amplitude occurs at maximum clockwise position.

c. SWEEP WIDTH: The scanning width of the instrument is governed by this control. When it is turned completely clockwise, the maximum spectrum width for which the instrument is designed, i.e., 10 megacycles can be seen on the screen. As the control is backed off in a counterclockwise direction, the bandwidth viewed becomes narrower. The part that can be seen, however, is expanded across the screen and hence is virtually magnified.

This control, in conjunction with the RESOLUTION control, is useful for separating two or more signal deflections which are so close as to merge into each other.

The panel calibration markings below maximum are only approximations and are to be considered as such. See paragraph 1.2 below.

d. SWEEP RATE: This provides for continuously adjustable scanning rates between 1 cps and 60 cps. Counterclockwise rotation results in reduced scan rate.

e. DIMMER: For operation of the equipments this control is rotated clockwise to turn on the power. Continuing clockwise rotation will reduce the edge illumination of the c-r tube screen on equipments using a type 5ADP7 c-r tube. On sets with a 5UP7, the control will dim the front panel pilot light.

f. VIDEO FILTER: This three-position switch will provide two degrees of video filtering to suppress such unwanted effects as noise, spurious beating between adjacent signals, hum, etc. The signal pips will be integrated and shifted slightly when the filter is in. An out position is provided.

g. RESOLUTION: Resolution, or the ability to separate individual signals, is dependent upon two factors: the rate of frequency scan and the bandwidth of the i-f section of the instrument. Optimum resolution requires a definite relationship between the two. Resolution sharpens as both the frequency-scanning rate and i-f bandwidth are decreased.

The RESOLUTION control is utilized to narrow the i-f bandwidth. Counterclockwise rotation of this control sharpens the width of the second i-f section. This control is a triple concentric potentiometer. It should be noted that as this control is adjusted, there will be some degree of change in the sensitivity of the equipment.

The frequency-scanning rate is diminished by increasing the scanning period or conversely by decreasing the spectrum width scanned within a given time. The SWEEP WIDTH control provides the latter method. For a given setting of the SWEEP WIDTH control there is a complementary setting of the RESOLUTION control to obtain optimum resolution.

h. CENTER FREQ.: This control serves to restore or maintain the FM local oscillator at its specified mean frequency. Thus, a deflection corresponding to the input center frequency appears at the center of the screen. Flatness of response in the Panalyzer, Panoramic Indicator and SPA-3 and proper peak location on the screen in the Panadaptor are dependent upon this control.

i. AMPLITUDE SCALE: Selection of linear, logarithmic or exponential amplitude presentations is accomplished with this three-position rotary switch. On the LOG position, signals having a 40 db (100:1) amplitude range may be viewed on the screen. In the LIN position signals having an amplitude ratio of 20 db (10:1) may be observed at one time. In the EXP position, the pip height varies as the square of the signal voltage for an approximate range of 4:1. It should be noted that because of the time constant factor, the LOG feature does not function properly with narrow pulses. Because of a-c coupling in the circuit the EXP feature functions properly only with narrow pips.

j. INTENSIFIER: To observe pulsed or noise signals, this control is turned in a clockwise direction. Noise and pulse signals will then intensity modulate the c-r tube beam. Normally, in using this control the BRILLIANCE control is adjusted so that the baseline just disappears. Intensity modulation then causes only the signals to appear on the screen in greater contrast.

k. FOCUS: The sharpness of the presentation is adjusted with this control.

l. BRILLIANCE: The intensity of the screen presentation is varied with this control.

m. GAIN: The amplitude of the indications are governed by this control. Low gain is to be used whenever possible to reduce the size of both spurious and noise deflections. Maximum gain obtains at maximum clockwise position.

1.2. Differential Markers (Optional)

Sets that are equipped with DIFFERENTIAL MARKERS to calibrate the frequency scale of the c-r tube screen will have the following additional controls:

a. MARKER AMP: This is the outside control of the concentric potentiometer. Rotating it clockwise will turn on the DIFFERENTIAL MARKERS. Continued clockwise rotation will increase the amplitude of the markers.

b. MARKER BAL.: This equalizes the amplitudes of the pair of differential markers.

c. DIFFERENTIAL MARKERS: The markers consist of a low frequency pip and a high frequency pip equally spaced about the center frequency. This control varies the markers frequency difference and its calibrated dial indicates this difference in megacycles.

1.3. Tuning Head Controls

The Tuning Head is found only on the Model SPA-1 Spectrum Analyzer.

a. TUNING KNOB: The frequency of the Tuning Head variable oscillator is varied with this knob in order to bring the desired test signals onto the screen of the analyzer section of the equipment. *

b. TUNING DIAL: The frequency of signals appearing at the center of the analyzer section screen is read on this dial.

c. OSCILLATOR LEVEL: This control is used to adjust the output amplitude of the Tuning Head oscillator. Maximum output is obtained in the maximum clockwise position. The output should be such that the reading of the CRYSTAL CURRENT meter is below 1 milli ampere. This may require reducing the input level to the SPA-1.

2. SEMI-ADJUSTABLE CONTROLS

These controls are in circuits which seldom require adjustment, and for this reason they are located on the top of the chassis.

a. VERTICAL POSITION: This adjusts the vertical position of the baseline trace on the c-r tube screen.

b. LINE SIZE: The horizontal length of the trace is adjusted with this control.

c. HOR. POSITION: This controls the position of the baseline trace along the horizontal axis.

* Care should be taken, when using the Tuning knob, not to hit against the stop at the low frequency end of the rotational range. Repeated blows may loosen the Butterfly capacitor, thereby necessitating extensive readjustment.

d. I.F. GAIN: This control is used to set the standard sensitivity of the equipment. Reserve gain is provided in the i-f section. When the sensitivity of the instrument falls below that specified, this control will require adjustment.

e. SWEEP LIMIT: The upper limit of sweep width obtainable with the SWEEP WIDTH control is set by this control.

f. CF PAD: This is a coarse adjustment for the mean center frequency of the local FM oscillator.

g. ASTIGMATISM: This adjusts the horizontal and vertical traces for relative focus. It may require adjustment if V18 or V19 is replaced. The astigmatism may also be readjusted slightly to compensate for the defocusing effect that occurs when the intensifier is operated.

h. LOG SCALE ADJUST: The accuracy of the log amplitude scale is governed by this control. It may require adjustment when the detector tube is replaced.

i. LOG ZERO ADJUST: This is adjusted in conjunction with the LOG SCALE ADJUST to provide accurate calibration over the entire log scale.

3. TERMS AND DEFINITIONS

a. Sweep width is the band, measured in cycles, kilocycles or megacycles, which can be observed by Panoramic Reception and which corresponds to the range of oscillator sweep in the Panoramic equipment.

b. [illegible] tions are produced and which can be calibrated in frequency according to a given frequency scale.

c. Center Frequency is the frequency of the signal received on that part of the frequency sweep axis corresponding to zero sweep voltage applied to the reactance modulator.

d. Resolution of a given signal is the frequency difference measured along the sweep width scale between the points where its deflection is 30% down from the peak value. This characteristic corresponds to "selectivity" in ordinary receivers. The smaller this frequency difference, the better the resolution is.

e. Sweep Frequency is the number of times per second the electron beam sweeps across the cathode-ray tube.

5-1

f. Deflection Amplitude is the visual equivalent of signal input voltage. It is the height of a given signal deflection measured from the baseline to the top of the deflections.

g. Screen Scale is the scale adjacent to the base line which is calibrated in frequency units above and below center frequency for a maximum sweep width setting.

h. External Oscillator is the associated unit which is used with the PANALYZOR to heterodyne with the test signal to produce the required input frequency of the PANALYZOR. In the Model SP-1 this oscillator forms part of the supplied Tuning Head.

NOTE: The heterodyne product should be the difference between the two frequencies used. If the sum frequency were used, spurious screen indications may result from heterodyne products of the test signals and the external signal generator output (including its harmonics).

SECTION II - INSTALLATION

1. UNPACKING

With the shipping container set right side up, remove the lids from the boxes. Carefully unpack the analyzer section, power supply and constant voltage transformer. Note that the power supply of the Model SPA-1 is contained in the same cabinet as the analyzer section. Remove all accessories from the case. Check contents against information in packing list. Any shortage or damage should be immediately reported to Panoramic Radio Products, Inc.

2. PRE-INSTALLATION TESTS

a. The power supplies of the Panacoustor, Panalyzor, Panoramic Indicator and Panoramic Spectrum Analyzer are factory wired for 115 volt, 50-60 cycle operation. In order to deliver a stable supply of this power requirement, a constant-voltage transformer is supplied. This transformer must be considered an integral part of the Panoramic equipment and must be used at all times. Do not, however, use it to supply power to auxiliary or additional equipments. For satisfactory operation of the Panoramic equipment, the c-v transformer must be used only within the input voltage range and only at the frequency specified on its nameplate. Normally, a c-v transformer with one of the following four voltage-frequency combinations is supplied, depending on the purchase order.

	Input Voltage	Frequency	Output Voltage
1.	95 - 125 V.	60 cps	115
2.	95 - 125 V.	50 cps	115
3.	190 - 250 V.	60 cps	115
4.	190 - 250 V.	50 cps	115

Connect the power supply to the analyzer section with the interconnecting power cable furnished. The SPA-1 is shipped with this cable already installed. Connect the constant-voltage transformer cord with the female plug to the power receptacle on the rear apron of the power supply chassis. Connect the c-v transformer cord with the male plug to the a-c line. Connect the supplied r-f input cable. In the case of the S5-5b this should be plugged into one of the two front panel r-f input connectors. In the case of the S5-5b, SC-5C and SPA-1 the cable should be plugged into the r-f input connector on the rear apron of the analyzer section chassis.

Turn the power on with the DIMMER control. The pilot light should go on at once. When the c-r tube is a 5ADP7, clockwise rotation of the DIMMER control should reduce the brightness of the edge lighting of the c-r t screen. When a 5UP7 is used, the DIMMER control dims the pilot light. Set the BRILLIANCE control between one half or two thirds of maximum clockwise position. Within five minutes the baseline trace should appear as a blurred or sharp line.

Now perform the following tests:

b. FOCUS: Turn this control through its range. The trace should become sharp or blurred. At some setting of the FOCUS control the baseline will be sharp. Leave the control at this position.

c. BRILLIANCE can be checked quickly by turning it through its range. The intensity should vary. Focus may also vary. This is normal. Return the control to a position giving a sharp bright trace.

d. INTENSIFIER: Set this control to its maximum counterclockwise position. Turn the GAIN, RESOLUTION and SWEEP WIDTH controls completely clockwise. Noise peaks may appear on the screen. If not, introduce noise or a signal into the equipment. Now turn the BRILLIANCE control counterclockwise until the deflections almost fade out. Turn up the INTENSIFIER. The noise lines or signal will become brighter but the baseline will not be present.

e. CENTER FREQ. Feed in a signal which corresponds in frequency to the input center frequency of the analyzer section, i.e., 30 mc. Set the GAIN, RESOLUTION and SWEEP WIDTH controls completely clockwise. SWEEP RATE to about 3/4 of its clockwise maximum position and AMPLITUDE SCALE to LIN. If necessary adjust HORIZONTAL POSITION so that the trace is centered on the screen. A pip corresponding to the signal should appear on or near the center of the screen. If the deflection consists of many vertical lines, lower the GAIN of the set until a single pip is present.

Turn the SWEEP WIDTH control counterclockwise. The pip will broaden and should remain on or near center. If it moves off the screen, trim CENTER FREQ. to maintain the centered condition. When the base of the pip occupies the entire screen, return the SWEEP WIDTH control to maximum clockwise position. The pip may now be off-center. If so, adjust HORIZONTAL POSITION to obtain center position.

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Turn the CENTER FREQ. control back and forth. The deflection should shift back and forth horizontally. Return the control to the pip center position.

f. GAIN: Rotation of this should change pip height.

g. SWEEP WIDTH: Set the controls as outlined for CENTER FREQ. test. With the SWEEP WIDTH control completely clockwise, vary the frequency of the signal generator between the limits of 25 mc to 35 mc.

When the limit frequencies are applied, corresponding deflections should appear within one-half division of the horizontal calibration extremities. This will indicate that the scanning width is within specifications.

h. RESOLUTION: Set the controls as outlined for CENTER FREQ. test. Feed in a signal which corresponds to the input center frequency of the analyzer section. Adjust the GAIN control or signal level to cause a full scale deflection. Gradually reduce the scanning width so that the pip base covers approximately one-third of the screen. Now turn the RESOLUTION control counterclockwise. The pip width should decrease. At the same time there may be a change in pip height. Rotation through the full range of the control may result in as much as a 30% change in pip height. It will also be noticed that small convolutions "ringing" will appear on the trailing edge of the pip. Optimum resolution occurs when the first convolution beyond the apex of the pip dips into the baseline.

i. AMPLITUDE SCALE: Set the controls as outlined for CENTER FREQ. test. Feed in a signal at center frequency and adjust pip height for full scale deflection. Switch the AMPLITUDE SCALE to LOG. The deflection should go down to 0 db. Switch to EXP. and vary the signal level. Full scale deflection should require about 4 times the signal for .1 scale.

j. SWEEP RATE: Set the CAL-SYNC SEL on CAL. At maximum clockwise rotation of SWEEP RATE one cycle of the line frequency should be visible. As the control is rotated counter-clockwise, the number of cycles visible should increase until at the end of the rotation, about 60 will appear. The sweep rate at any position is equal to 60 cps divided by the number of cycles visible. At low rates, it is easier to count sweeps, using a stop watch for timing, than to count cycles.

k. SYNC AMP: With the CAL-SYNC SEL still in the CAL position slowly advancing this control, some setting should cause the sine wave display on the screen to "lock in". That is, there should be no drifting horizontally in either direction.

l. CAL-SYNC SEL: For the CAL position see steps j and k. In the LINE position, move the base line to one side with the HOR. POS. control so that the end of the line is visible. The SWEEP RATE control should be set for approximately 30 or 60 cps. SYNC AMP should be maximum counter-clockwise. The end of the line will then appear to move back and forth. Slowly advance the SYNC AMP. control. At about 1/4 rotation, the sweep should be synchronized so that the base line will then remain stationary.

In the EXT position feed 60 cps from the secondary of a filament transformer (or from any other available low voltage supply at the line frequency) to the EXT SYNC jack. Repeat as in the LINE position.

m. VIDEO FILTER: As this is switched in, any noise on the screen should be filtered, and signal pips will be integrated and shifted slightly. Greatest effect will be noticed in the HIGH position.

When the instrument contains differential markers, the following additional performance checks should be made. Use the controls settings as were used for the CENTER FREQUENCY test. Set SWEEP WIDTH to 1.0.

n. MARKER AMPLITUDE: The markers are turned on by clockwise rotation of this control. Continued clockwise rotation should increase the amplitude of the marker presentation. *

o. MARKER BALANCE: If the DIFFERENTIAL MARKER Dial is set to other than "0", two marker pips should appear on the screen. Turning MARKER BALANCE through its rotation range should make first one marker then the other the larger. At some point the two markers will have the same amplitude. Leave the control in this position.

p. DIFFERENTIAL MARKERS: With the DIFFERENTIAL MARKERS Dial on "0" one marker pip should appear at the center of the screen. As the dial is turned towards "10", two pips should appear equally spaced about the center of the screen. With the dial on "10", the marker pips should appear at the edges of the screen calibration. A smaller amplitude pip will also appear at the center. Note that as DIFFERENTIAL MARKERS is rotated, there may be a small degree of horizontal shift in the Marker presentation. This is normal. The frequency difference should be correct.

The following additional tests should be made on the Model SPA-1. Be sure that the cabling is correct for the desired mode of operation. See 3e below.

* To avoid spurious marker pips, the control should be adjusted so that the pip height is no more than full scale on LIN and no more than 1/2 scale on LOG.

q. With the analyzer section controls set as far as the CENTER FREQUENCY test set the Tuning Dial to some convenient frequency.* Feed a signal of this frequency to the SIGNAL INPUT connector on the Tuning Head. A signal pip should appear at the center of the screen. Vary the setting of OSC. LEVEL. This should affect the height of signal presentation. At some particular setting the signal presentation should be maximum and the signal to noise ratio best. Check several points on the Tuning Dial.

Additional information on service or adjustments affecting the foregoing controls is contained in the Maintenance Section of this handbook

3. INSTALLATION

a. CONNECTION OF PANADAPTOR MODEL SA-8b TO RECEIVER

Find a suitable place to locate the Panadaptor near the companion receiver. If possible do not mount the Panadaptor over ventilation holes of the receiver. Place the Panadaptor in such a position that direct sun light or other strong light does not fall on the screen.

(1) Be sure that the receiver has an i-f which corresponds to the input frequency of the Panadaptor, i.e., 30 megacycles.

(2) Disconnect the receiver from the power line.

(3) Attach the inner conductor of the r-f coaxial cable directly to the output of the cathode follower provided in the receiver for connection of a Panadaptor. The male plug at the other end of the cable is fitted into the input r-f connector on the rear of the Panadaptor.

IF THE COMPANION RECEIVER IS NOT PROVIDED WITH A CATHODE FOLLOWER FOR OPERATION WITH A PANADAPTOR, PROCEED AS FOLLOWS:

Install a circuit like the one in Figure 3. Determine where a hole cluster to mount the tube socket can be drilled in the receiver chassis so that the shortest connection cable can be used between the receiver and the Panadaptor. Drill a hole cluster suitable for mounting a standard type N receptacle (as in the Panadaptor). Now connect the inside conductor of a shielded cable to the cathode pin of the cathode follower socket through a .01 mfd capacitor. Connect the other end of the inside conductor to the center pin of the Type N connector. Ground the shield of the cable.

*. See foot note on Page 9

(4) Connect the power supply and analyzer section as outlined in Paragraph 2 in the foregoing, Pre-Installation Tests. Plug the constant-voltage transformer into the power supply. Plug the constant-voltage transformer into the power source.

(5) Turn on the Panadaptor and receiver. Check the operation by following the operating procedure in Section III.

b. CONNECTION OF PANALYZOR, MODEL SB-8b: Installation of the Panalyzor is simple. Find a suitable location for the Panalyzor. Avoid locations which will allow strong light to fall on the screen. Locate for effective ventilation.

Connect the power supply to the analyzer section as outlined in Paragraph 2 in the foregoing, Pre-installation Tests. Plug the constant-voltage transformer into the power supply. Plug the constant-voltage transformer into the power source.

To one of the two r-f input connectors on the front panel connect the external oscillator or signal generator. Use either the cable supplied or the generator cable.

NOTE: If the signal generator frequency is not varied during examination of the test signal, the connecting cable does not have to match the 50 ohm input impedance of the Panalyzor. This also applies when flatness of response is not critical. Otherwise the generator cable must be 50 ohms and nonterminated or a suitable pad may be used to prevent reflections and the resultant nonuniform response due to mismatch.

To the other r-f connector attach the cable supplied. The other end of the cable may be coupled to the test signal capacitively or inductively as may be required. (A small loop may be attached to the end of the cable.)

If the test signal has a d-c component and the Panoramic cable is to be connected directly to the signal source, a blocking capacitor should be used at the free end of the cable.

c. CONNECTION OF PANORAMIC INDICATOR, MODEL SC-8b: Find a suitable location for the Indicator. Avoid locations which will allow strong light to fall on the screen. Locate for effective ventilation. Connect the power supply to the analyzer section as outlined in Paragraph 2 in the foregoing, Pre-Installation Tests. Plug the constant-voltage transformer into the power supply. Plug the constant-voltage transformer into the power source.

(1) If the signals to be examined are between 25 and 35 MC, the r-f cable supplied with the equipment can be used to connect the r-f input connector on the rear of the SC-8b to the signal source.

(2) If the frequencies to be observed are above or below the range of 25 to 35 MC, then a suitable external mixer and an external oscillator or signal generator that provides the necessary frequency range will be needed. The signal under test is connected to the mixer as is the output of the signal generator. The output of the mixer is then connected to the r-f input connector at the rear of the SC-8b.

A mixer used for this purpose must have the following characteristics.

1. The output must be tuned from 25 to 35 megacycles.

2. If the Panoramic Bandpass Amplifier, Model DA-1 is used, a low noise figure mixer is required.

3. The output should be able to be terminated by the 50-ohm input impedance of the Panoramic equipment.

d. CONNECTION OF DA-1 BANDPASS AMPLIFIER WITH SA-8b, SB-8b or SC-8b EQUIPMENT: Where the need for additional sensitivity requires the use of the Panoramic Bandpass Amplifier, Model DA-1, the additional installation required is as follows:

(1) Panadaptor SA-8b: Installation is the same as in 3a except that in step 3 the male plug at the end of the cable is connected to the INPUT connector of the DA-1. The OUTPUT connector of the DA-1 is then connected to the r-f INPUT connector on the rear of the Panadaptor.

(2) Panalyzor SB-8b: Installation is the same as in 3b except that the signal is connected to the INPUT connector of the DA-1. The OUTPUT connector is then connected to more sensitive INPUT connector on the Panalyzor.

Because of the DA-1, signal inputs are limited to the range of 25 - 35 MC. A signal generator cannot be used at the other input connector of the Panalyzor in the usual manner. To extend the range, an external mixer must be used with the output of the mixer connected to the INPUT of the DA-1. For information concerning a mixer, see 3c(2).

(3) Panoramic Indicator SC-8b: Installation is the same as in 3c except that the signal or the output of the mixer is connected to the INPUT of the DA-1 and the OUTPUT connector of the DA-1 is connected to the r-f input connector on the rear apron of the analyzer section chassis.

e. INSTALLATION OF A SPECTRUM ANALYZER, MODEL SPA-1: Find a suitable location for the Model SPA-1. Avoid locations that will allow strong light to fall on the screen. Locate for effective ventilation.

The Model SPA-1 is normally shipped with all interconnecting cables amongst the various units (except the constant-voltage transformer) already installed. It is only necessary to plug one of the c-v transformer cords into the power supply section and the other cord into the a-c power line. Be sure that all plugs are well seated. Note that there are two cables with plugs at one end only. They connect the right and left side of the power supply to the center (junction) section of the power supply. In addition there is a cable with plug at one end only that connects the PRA-1 to the center (junction) section of the power supply.

The following is the normal intercabling when the SPA-1 is shipped.

1. 12-pin power cable between analyzer section and power supply section.

2. RG-8/U r-f cable from MIXER OUTPUT connector on power supply chassis to INPUT connector of PRA-1.*

3. RG-8/U r-f cable from OUTPUT connector of PRA-1 to INPUT connector on rear apron of analyzer chassis.*

Connect the test signal to the SIGNAL INPUT connector on the front panel of the Tuning Head using the supplied r-f cable. A Tuned loop or other suitable signal pick up device may be used to couple the test signal to the input cable. If the test signal has a d-c component and the signal source is connected directly to the r-f input cable a blocking capacitor should be used between the signal source and the cable. In order to minimize standing waves due to impedance mismatch, an adjustable double-stub should be employed. It should be placed near the SPA-1 INPUT. If the resultant loss in sensitivity is not objectionable a 20-db fixed attenuator might be used in place of the double-stub system.

By use of a mixer that can efficiently mix signals of higher frequency than 4,000 megacycles, in place of the supplied mixer, the frequency coverage of the Model SPA-1 can be increased. This involves using higher order harmonics of the supplied Tuning Head, with an accompanying loss in sensitivity. The mixer used must have the same characteristics as those listed under section 3a(7) above.

* When a PRA-1 is not supplied or not used, the MIXER OUTPUT connector is cabled directly to the analyzer section INPUT connector.

SECTION III - OPERATION

1. GENERAL OPERATION, PANADAPTOR, MODEL SA-8b

The Panadaptor provides continuous automatic visual presentation of signals present within a given band. Signals appear on the screen as inverted "V" deflections. The signal or station to which the receiver is tuned is seen as a deflection at or very near the center of the screen, while others which are not heard at the time appear to the left or right of center depending upon their frequencies. As the receiver is tuned, the deflection will move across the screen. As a deflection approaches the center of the screen its corresponding signal will be heard through the receiver.

a. Check the receiver for proper alignment and functioning of all controls. Turn on the receiver in the normal manner. Its controls, where applicable, should be set approximately as given below:

(1) R.F. Gain - near maximum
(2) A.F. Gain - normal
(3) AVC - off
(4) Selectivity controls - normal
(5) Crystal - In or Out
(6) BFO - Off
(7) Bandswitch - to band of interest or where traffic is heavy
(8) ANL - Off
(9) Antenna trimmer - normal for the particular antenna in use

b. Turn on the Panadaptor with the DIMMER control until the baseline trace appears. This should usually be within five minutes. With a few sets it may take as long as 15 minutes. Set the front panel controls as given below.

(1) CENTER FREQ. - on vertical marker (See Section II, Par. 2e. So that the Panadaptor matches the receiver intermediate frequency, the 30 megacycle signal used for this adjustment should be derived from the receiver.)
(2) SWEEPWIDTH - maximum clockwise
(3) RESOLUTION - maximum clockwise
(4) BRILLIANCE - for desired trace brightness
(5) INTENSIFIER - maximum counterclockwise
(6) FOCUS - sharpest trace
(7) AMPLITUDE SCALE - to LIN
(8) GAIN - between half and maximum clockwise position
(9) SWEEP RATE - to approximately 3/4 max. clockwise*
(10) VIDEO FILTER - to "OUT" POSITION
(11) CAL-SYNC SEL - to "LINE"*
(12) SYNC AMPLITUDE - about 1/4 of clockwise rotation*

*See Section II, paragraphs 2j, k, l for additional information concerning sweep rate and synch adjustments.

If the band to which the receiver is tuned is well "populated", signal deflections of various amplitudes should be visible on the screen. If not or if a particular signal is being searched, rotate the receiver tuning dial until the signals or signal come into view.

Tune in the signal so that it is heard through the receiver.

The deflection corresponding to the signal should be directly over the zero mark on the panoramic screen. If it is not, center it by the following procedure:

(1) Tune in the station as accurately as possible.
(2) Rotate the SWEEPWIDTH control almost fully counterclockwise, at the same time keeping the "spread out" peak centered with the CENTER FREQ. control.
(3) Return the SWEEPWIDTH control to maximum clockwise position.
(4) If the peak is now off center, carefully rotate the HORIZONTAL POSITION control until the deflection is centered.

c. Always use as low a gain setting on the Panadaptor as possible while still being able to see weak stations heard on the receiver. Excessively high gain may cause jumpy noise deflections to appear. These will at times cause confusion since it is sometimes difficult to differentiate between noise and signals.

d. When AVC is used in the receiver, the signal appearing at the center of the screen will control the heights of other deflections. Therefore if a strong signal is tuned in, weaker adjacent signals may be so reduced that they do not appear. It will be found expedient, in most applications, to operate the receiver with AVC off.

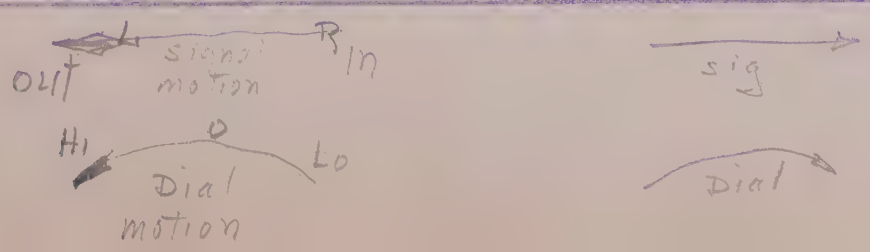
e. The relative frequencies of signals appearing on the screen may be quickly determined from the screen calibrations and the receiver tuning dial. The frequency of the signal appearing at the center of the screen may be read off the receiver dial. The frequency of other signals is obtained by adding or subtracting the screen calibration for the given signal to the frequency reading on the receiver dial.

NOTE: The polarity (- or +) of the calibration will apply when the local oscillator of the receiver is above the received signal.

When the local oscillator is lower in frequency the signs are reversed.

For example: at maximum scanning width each frequency calibration mark for the T-10,000 is equivalent to a 1 MC separation. If the deflection appears at -4 and the receiver is tuned to 117 MC, the pip corresponds to a signal of 121 MC provided that the local oscillator tracks above the tuned signals. If the oscillator tracks below the signal frequency would be 113 MC.

When the local oscillator tracks above the signals, the deflections will move from right to left as the receiver is tuned upward in frequency.



f. The relative strengths of the received signals are roughly determined by the respective height of each pip. As the receiver is tuned it will be noted that the pip height will vary as the pip traverses the screen. The Panadaptor is designed to compensate for receiver selectivity through the use of a quadruple peaked input stage. Compensation is not perfect since receiver selectivity will vary. Consequently, pip height will not be uniform throughout the screen.

To observe simultaneously signals which cause pips having an amplitude ratio no greater than 10:1 keep AMPLITUDE SCALE on LIN. For observation of pips having a greater amplitude ratio switch AMPLITUDE SCALE to LOG. This will allow simultaneous viewing of signals which may differ as much as 100:1 in height. The EXP position of the switch will accent the differences of amplitude and help in distinguishing between noise and signal. The LOW and HIGH positions of the VIDEO FILTER permits additional separation of noise and signal.

g. Interpretation of screen presentations will be found in paragraph 8 of this section. Operating procedure for pulses is contained in paragraph 7. Information on Narrow Band Analysis is given in paragraph 5. Information on operation of Differential Markers appears in paragraph 6.

2. GENERAL OPERATION, PANALYZOR, MODEL SB-8b

a. Turn on the power with the DIMMER control and allow one half hour warm-up period before operating adjustments are made. When the baseline appears, set up the controls as follows. The baseline usually appears within five minutes. With a few sets it may take as long as 15 minutes.

(1) CENTER FREQ. - on vertical marker (See Section II, Par. 2 e)
(2) SWEEPWIDTH - maximum clockwise
(3) RESOLUTION - maximum clockwise
(4) BRILLIANCE - for desired trace brightness
(5) INTENSIFIER - maximum counterclockwise
(6) FOCUS - sharpest trace
(7) AMPLITUDE SCALE - to LIN
(8) GAIN - between half and maximum clockwise
(9) SWEEP RATE - to approximately 3/4 max. clockwise*
(10) VIDEO FILTER - Set to "OUT"
(11) CAL-SYNC SEL - to "LINE"*
(12) SYNC AMPLITUDE - about 1/4 of clockwise rotation*

When the SWEEPWIDTH and RESOLUTION controls are concurrently set close to their maximum counterclockwise position the centered signal will appear as an elevated baseline or pip with hum superimposed. This is normal.

* See Section II, paragraphs 2j, k, l for additional information concerning sweep rate and synch adjustments.

Although the frequency of the external heterodyning oscillator or signal generator which is connected to one of the input r-f connectors may be either 30 megacycles above or 30 megacycles below the test-signal frequency, use the following rules in choosing this frequency: If possible, do not use a frequency within the 25-35 megacycle input range of the Panalyzor. Also, frequencies whose harmonics fall within that range of the Panalyzor. Also, frequencies whose harmonics fall within that range should be avoided. Therefore, for all test-signal frequencies up to 67 megacycles use a signal-generator frequency 30 megacycles above the test-signal frequency. For test-signal frequencies between 67 and 150 megacycles, a signal-generator frequency above the test-signal frequency is preferable but not essential. This will avoid the presence of image frequencies. For frequencies above 150 megacycles no advantage will be gained by having the signal-generator frequency above that of the test signal.

NOTE: The signal generator frequency can be recognized as being below the test signal frequency if the pip moves from left (-) to right (+) as the generator frequency is increased. When the generator frequency is above the test signal frequency a pip will move from right (+) to left (-) as the generator frequency is increased. When the frequency of the external oscillator is above the test signals, the plus and minus signs on the screen apply; that is signals on the (+) side are higher in frequency than the center signal while those on the (-) side are lower. If the oscillator frequency is below the test signals, the signs are reversed. Note that when 25 - 35 megacycles is fed directly into the input, the screen signs are reversed.

Slowly search the spectrum with the external oscillator until the signal appears at the center of the screen.

To locate the signal, it may be found convenient to operate the analyzer at maximum gain and the signal generator for high output. Once the signal is located, the GAIN control may be backed off counterclockwise and the generator output lowered to obtain a signal which falls below full scale.

b. Frequencies of signals appearing on the screen may be quickly determined by adding or subtracting the screen calibration for a given signal to the frequency to which the signal generator is adjusted and then subtracting or adding the input center frequency. See NOTE in Par. 2 a above.

Example: A T-10,000 is set for maximum scanning width. A pip appears at +3. The heterodyne oscillator is set to 107 MC.

The input center frequency of the T-10,000 is 30 MC. When the generator is raised, the signal moves right to left. Therefore, the screen calibration is added in this example since it is determined, by following the procedure indicated in NOTE of Par. 2 a above, that the oscillator was above the test signal. Therefore, the + sign applied.

Signal Freq. Oscillator Freq ± Screen Calib. ± Input Center Freq.

Signal Freq = 107 MC + 3 MC -30 MC = 80 MC.

c. The relative amplitudes of presented signals are proportional to the relative heights of the corresponding deflections, within the limits specified for flatness of response. The use of a pre-amplifier such as the DA-1 may effect this flatness.

To observe signals of comparative amplitude, the AMP SCALE should be set to LIN. On the other hand, examination of signals widely divergant in amplitude will require LOG setting of this CONTROL. This will allow simultaneous reading of amplitudes having a 40 db range. On the EXP position, differences in amplitude will be accented permitting improved signal to noise ratio on the screen. Additional improvement can be obtained by setting the VIDEO FILTER to either LOW or HIGH.

d. See paragraphs 5, 6, 7 and 8 for additional applicable information on use of the Differential Markers, Narrow Band Analysis, Pulse Operation, Interpretation of Screen Representation.

3. GENERAL OPERATION, PANORAMIC INDICATOR MODEL SC-8b

a. Turn on the power and allow one half hour warm-up period before operating adjustments are made. When the baseline appears, set up the controls as follows. The baseline usually appears within five minutes. With a few sets it may take as long as fifteen minutes.

(1) CENTER FREQ. - on vertical marker (See Section II, Par. 2 e)
(2) SWEEP WIDTH - maximum clockwise
(3) RESOLUTION - maximum clockwise
(4) BRILLIANCE - for desired trace brightness
(5) INTENSIFIER - maximum counterclockwise
(6) FOCUS - sharpest trace
(7) AMPLITUDE SCALE - to LIN
(8) GAIN - between half and maximum clockwise
(9) SWEEP RATE - to approximately 3/4 max. clockwise*
(10) VIDEO FILTER - Set to "OUT"
(11) CAL-SYNC SEL - to "LINE"*
(12) SYNC AMPLITUDE - about 1/4 of clockwise rotation*

When the SWEEP WIDTH and RESOLUTION controls are concurrently set close to their maximum counterclockwise position, the centered signal will appear as an elevated baseline or pip with hum superimposed. This is normal.

* See Section II, paragraphs 2 j, k, l for additional information concerning sweep rate and synch adjustments.

Although the frequency of the external heterodyning oscillator or signal generator which is connected to one input of the external mixer may be either 30 megacycles above or 30 megacycles below the test-signal frequency, use the following rules in choosing this frequency: If possible, do not use a frequency within the 25-35 megacycle input range of the Panoramic Indicator. Also, frequencies whose harmonics fall within that range of the Panoramic Indicator. Also, frequencies whose harmonics fall within that range should be avoided. Therefore, for all test-signal frequencies up to 67 megacycles use a signal-generator frequency 30 megacycles above the test-signal frequency. For test-signal frequencies between 67 and 150 megacycles, a signal-generator frequency above the test-signal frequency is preferable but not essential. This will avoid the presence of image frequencies. For frequencies above 150 megacycles, no advantage will be gained by having the signal-generator frequency above that of the test signal.

NOTE: The signal generator frequency can be recognized as being below the test signal frequency if the pip moves from left (-) to right (+) as the generator frequency is increased. When the generator frequency is above the test signal frequency a pip will move from right (+) to left (-) as the generator frequency is increased. When the frequency of the external oscillator is above the test signals, the plus and minus signs on the screen apply, that is signals on the (+) side are higher in frequency than the center signal while those on the (-) side are lower. If the oscillator frequency is below the test signals, the signs are reversed. Note that when 25 - 35 megacycles is fed directly into the input, the screen signs are reversed.

Slowly search the spectrum with the external oscillator until the signal appears at the center of the screen.

To locate the signal, it may be found convenient to operate the analyzer at maximum gain and the signal generator for high output. Once the signal is located, the GAIN control may be backed off counterclockwise and the generator output lowered to obtain a signal which falls below full scale

b. Frequencies of signals appearing on the screen may be determined by the method of Par. 2 b.

c. Refer to Par. 2 c for information as to amplitude determination. See Par. 5, 6, 7 and 8 for additional applicable information on use of the Differential Markers, Narrow Band Analysis, Pulse Operation and Interpretation of Screen Representation.

X X X

4. GENERAL OPERATION, PANORAMIC SPECTRUM ANALYZER, MODEL SPA-1

a. Turn on the power with the DIMMER control and allow a half hour warm-up period before operating adjustments are made. When the baseline appears,

set up the controls as follows. The baseline usually appears within five minutes. With a few sets it may take as long as fifteen minutes.

(1) CENTER FREQ. - on vertical marker (See Section II, Par. 2 e)
(2) SWEEP WIDTH - maximum clockwise
(3) RESOLUTION - maximum clockwise
(4) BRILLIANCE - for desired trace brightness
(5) INTENSIFIER - maximum counterclockwise
(6) FOCUS - sharpest trace
(7) AMPLITUDE SCALE - to LIN
(8) GAIN - between half and maximum clockwise
(9) SWEEP RATE - to approximately 3/4 max. clockwise*
(10) VIDEO FILTER - Set to "OUT"
(11) CAL-SYNC SEL - to "LINE"*
(12) SYNC AMPLITUDE - about 1/4 of clockwise rotation*
(13) OSC LEVEL (In Tuning Head) - midrotation

When the SWEEP WIDTH and RESOLUTION controls are concurrently set close to their maximum counterclockwise position, the centered signal will appear as an elevated baseline or pip with hum superimposed. This is normal.

If the frequency band of interest is known, set the tuning dial** to a point on the dial for which such signals might be expected to appear. Slowly search this portion of the spectrum, using the Tuning Head dial until the signals of interest appear on the screen. The Tuning Head dial is calibrated in terms of the frequency of a signal at the center of the screen, i.e., the Tuning Head oscillator frequency minus 30 megacycles (except for the highest frequency calibration point on the dial which is calibrated in terms of oscillator frequency plus 30 megacycles).

The OSC LEVEL control should be adjusted for maximum pip height. This will also result in best the signal-to-noise figure. Note, however, that for best crystal mixer life the oscillator level and/or the test signal input level to the SPA-1 should be such that the reading of the CRYSTAL CURRENT meter is below one milliampere. It should be observed that the adjustment of the OSC LEVEL control will have some affect on frequency at the high end of the oscillator frequency range.

To locate the signal, it may be found convenient to operate the analyzer at maximum gain and the OSC LEVEL for high output. Once the signal is located, the GAIN control may be backed off counterclockwise and the OSC LEVEL lowered to obtain a signal which falls below full scale.

b. In order to determine absolute frequencies precisely, an absorption type of wavemeter should be inserted between the signal source and the SPA-1 SIGNAL INPUT connector. The wavemeter is then tuned through the range involved. When the signal pip disappears from the screen, or goes through a minimum, the wavemeter is set to the frequency causing the pip.

c. Refer to Par. 2 c for information as to amplitude determination. See Par. 5, 6, 7 and 8 for additional applicable information on use of the Differential Markers, Narrow Band Analysis, Pulse Operation and Interpretation of Screen Representation.

**See footnote on Page 9

* See Section II, paragraphs 2 j, k, l for additional information concerning sweep rate and synch adjustments.

5. OPERATION WITH DIFFERENTIAL MARKERS

With equipments provided with Differential Markers,

(1) Turn on Markers by turning the MARKER AMP. control clockwise. Continue rotation until Marker pips are of 1/2 to full scale height.*

(2) Adjust MARKER BAL. control to equalize the heights of the Markers.

(3) The distance between the two markers is varied with the DIFFERENTIAL MARKERS tuning control and the sweep width read directly from the calibrated dial. If their frequency difference is greater than the sweep width as set by the SWEEP WIDTH control, then the Markers will not appear on the screen. Turning the SWEEP WIDTH control clockwise will bring the Markers back on the screen.

(4) The Differential Markers provide more accuracy for the frequency determination as outlined in Par. 2 b. They also, assist in measurement of the width of the spectrum for such applications as pulsed r-f signals.

6. NARROW BAND ANALYSIS

When signals or a carrier and its sidebands are so closely spaced in frequency that at full sweep width their corresponding deflections tend to merge into each other or mask one another, it may be possible to separate or resolve them by sharpening the i-f bandwidth, and concurrently reducing the scanning width or by reducing the scanning rate or by doing both of the foregoing.

a. To obtain greater resolution by increasing the scanning time, lower the SWEEP RATE by rotating the SWEEP RATE control counterclockwise. Readjust SYNC AMP to keep the sweep in sync

b. To increase the resolution capabilities by diminishing scanning width, narrowing the i-f bandwidth, and increasing scanning time use the following procedure:

(1) Keep the RESOLUTION control on 1.0 (broad)

(2) With the receiver or external oscillator tune in the particular band of signals to the center of the screen.

(3) Spread the band of signals across the screen by turning the SWEEP WIDTH knob counterclockwise. Note that at reduced scanning width each frequency calibration mark represents a frequency separation equal to one tenth of the reduced sweep width. Keep the band centered with the CENTER FREQ control.

(4) Turn the RESOLUTION control counterclockwise until individual signals are most clearly resolved.

* Because of the fact that if operated for full scale on LOG amplitude, spurious pips will appear, it is important not to exceed 1/2 scale Marker pips when AMPLITUDE SCALE is on LOG.

NOTE: Rotation of the RESOLUTION control may result in increased or decreased pip height. Pip amplitude may be returned to suitable level with the GAIN control. Turning the RESOLUTION control counterclockwise after optimum resolution is reached will decrease the resolving power and result in greatly reduced sensitivity.

If the resolution adjustment results in practically complete separation of signal pips maximum resolution can be recognised by the presence of "ringing" on one side of the pip. "Ringing" can be seen more easily with the video filter in the "out" position.

Illustrations (A) to (F) indicate progressive variations in pip width effected by counterclockwise rotation of RESOLUTION control. In (A) and (B) I-F width is broad for particular scanning velocity. (C) shows beginning of "ringing." Extent of "ringing" in (D) shows optimum resolution. As the I-F section is made narrower, excessive "ringing" widens pip, amplitude decreases.

(5) Further counterclockwise rotation of the RESOLUTION control cause a reduction in amplitude and a tendency of remerging of the pips. To better separate the signals the SWEEP WIDTH and RESOLUTION controls can be further backed off counterclockwise and the SWEEP RATE set to a lower rate.

If it is mandatory to observe a given bandwidth at one time and the signals contained therein are so closely spaced that they cannot be completely resolved, maximum resolution is recognized by the appearance of the clearest picture. Further counterclockwise rotation of the resolution will result in lessened resolution and a "bobbing" presentation.

7. OPERATING PROCEDURE FOR PULSED SIGNALS

Pulse signals are composed of a series of pulses which are of relatively short duration. Therefore, a peak produced by one of these pulses traverses the screen vertically for so short a period of time that the c-r tube screen is insufficiently excited to produce a visible trace. Merely

turning up the BRILLIANCE control does not help because the increased brightness of the baseline tends to "wash out" the pulse pattern. Therefore, the following procedure is used.

a. Follow the regular operating procedure.
b. Reduce the intensity of the baseline trace so that it is barely visible.
c. Turn the INTENSIFIER control clockwise. The pulse peaks should come into view while the baseline is not equally apparent. If necessary, use the FOCUS control.
NOTE: The LOG position of AMPLITUDE SCALE does not function properly when narrow pulses are involved.

8. INTERPRETATION OF SIGNALS

With a little experience, the operator will be able to recognize visually the character of the various types of signals.

(1) A constant carrier appears as a deflection of fixed height.

(2) An amplitude-modulated carrier appears as a deflection of variable height. Non-constant tone modulation of low frequency will produce a series of convolutions varying in height, their number being determined by the modulation frequency. The nature of the presentation will depend upon the scanning width.

As the modulation frequency increases, the convolutions move toward the two sides of the deflection, as the side bands tend to become visible. When the modulation frequency is increased, it becomes possible to separate the side bands by reducing the sweep width of the analyzer. The resolution control will enable further separation. The higher the frequency of modulation, the farther away these sidebands will move from the center deflections, representing the carrier. One should remember that due to possible non-linear amplification of the receiver or of the analyzer, or both, over a wide band, the sidebands may appear unequal in height, even though they are of equal strength. Their relative heights may vary as the receiver is tuned and as the deflection moves from one end of the screen to the other.

(3) Single side-band modulation appears as two carriers of slightly different frequency (see below "Signal Interference").

(4) A carrier frequency modulated at low rate appears as a carrier which wobbles sideways.

(5) A CW signal appears and disappears in step with the keying of the transmitter. During the moments when the signal is off, the frequency sweep axis is closed at the base of the signal. In very rapidly keyed signals the deflection and the baseline are seen simultaneously.

(6) A MCW signal appears like a CW signal of periodical varying height. If the modulation rate is high, sidebands will appear as explained above.

(7) Signal Interference. Two signals which are so close in frequency as to cause aural interference (beats) may appear on the screen as a single deflection, varying in height as with a modulated signal. As the frequency separation is increased, the deflection appears as if modulated on one side only. Further increase of frequency will cause a "break" in the apex of the deflection. By reducing the sweep width of the analyxer, the respective deflection will gradually separate. Further separation is effected with the Resolution Control and by setting the SWEEP RATE to a lower rate.

(8) Transient disturbances, generally examined, are of two types: periodic and aperiodic transients.

Periodic transients, such as produced by motors, vibrators, buzzers, etc., appear as signals moving along the frequency sweep base line in one direction or another. Thus an engine which is accelerating will produce a set of deflections which may move first in one direction, slow down, stop and then move in an opposite direction. This is caused by the fact that the analyzer is sweeping at a fixed rate, whereas the transient occurs at a variable rate. The images stand still on the screen when there is synchronism between the two. If the transient disturbance is synchronized with the 60 cycle line, the "noise" appears as a fixed signal which, however, does not move on the screen when the receiver is tuned, but only varies in height. Such deflections may appear like amplitude modulated signals or like steady carrier. Aperiodic transients, such as "static" appear as irregular deflections and flashes along the whole frequency sweep axis.

(9) Images. If the receiver or converter allows "images" to pass (due to poor image rejection of ther-f circuit) these will be distinguishable from normal signals by the fact that they move in an opposite direction with respect to normal signals on the screen of the analyzer when the companion receiver or external oscillator is being tuned. Such images are most likely to appear on the higher frequency ranges of the receiver.

(10) Harmonics produced in the converter or receiver by the beat of very strong signals with harmonics of the oscillator, will be distinguishable from other signals by the fact that they move on the screen more rapidly (with tuning) than the normal signals (twice as fast for second harmonic spurious signals). Generally a reduction in the gain of the receiver will eliminate this type of spurious signal.

(11) Diatherny or other apperatus using an unfiltered or a-c power supply will produce a periodic disturbance which will cause a deflection to

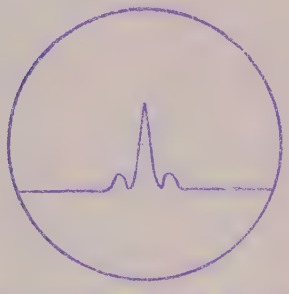
appear on certain portions of the screen and disappear on other portions. This is due to the fact that such equipment emits a signal pulsating in synchronism with power line. On the other hand, the analyzer too, is sweeping the spectrum in synchronism with the line, but at a lower frequency and only when a certain phase relationship exists is it possible for the anadyzer to receive those periodic pulses.

In order to examine signals which are synchronized to the line frequency, set the CAL-SYNC SEL. to LINE, SYNC AMP to maximum counter-clockwise and adjust the RATE control for the best presentation across the entire screen. This provides the asynchronous operation necessary to see the entire signal. The SYNC. AMP. control can be used to provide synchronism in order to "capture" an interesting portion of the display.

(12) Spurious Signals. If the signal strength exceeds a certain value, the deflection caused by any signal breaks up into a series of parallel deflections, somewhat similar to side-bands. These spurious signals can take place either in the receiver or analyzer on extremely strong signals. Attenuation of signal input level will remedy this

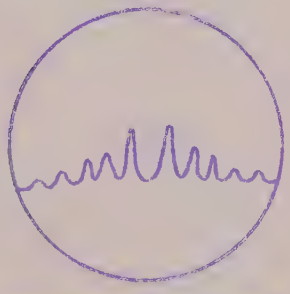
1. Constant carrier signal. Sweep width control adjusted for approximately maximum sweep width.

2. Appearance of constant carrier at reduced sweep width.

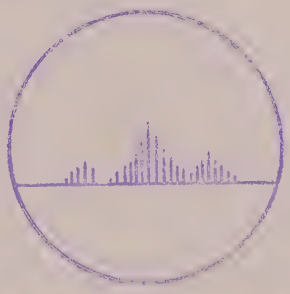


3. Illustration of an amplitude modulated signal showing carrier at 0 on screen and two side bands.

4. Same AM signal as in 3 except sweep width is reduced, carrier remains at center of screen.



5. Frequency distribution of an FM signal.

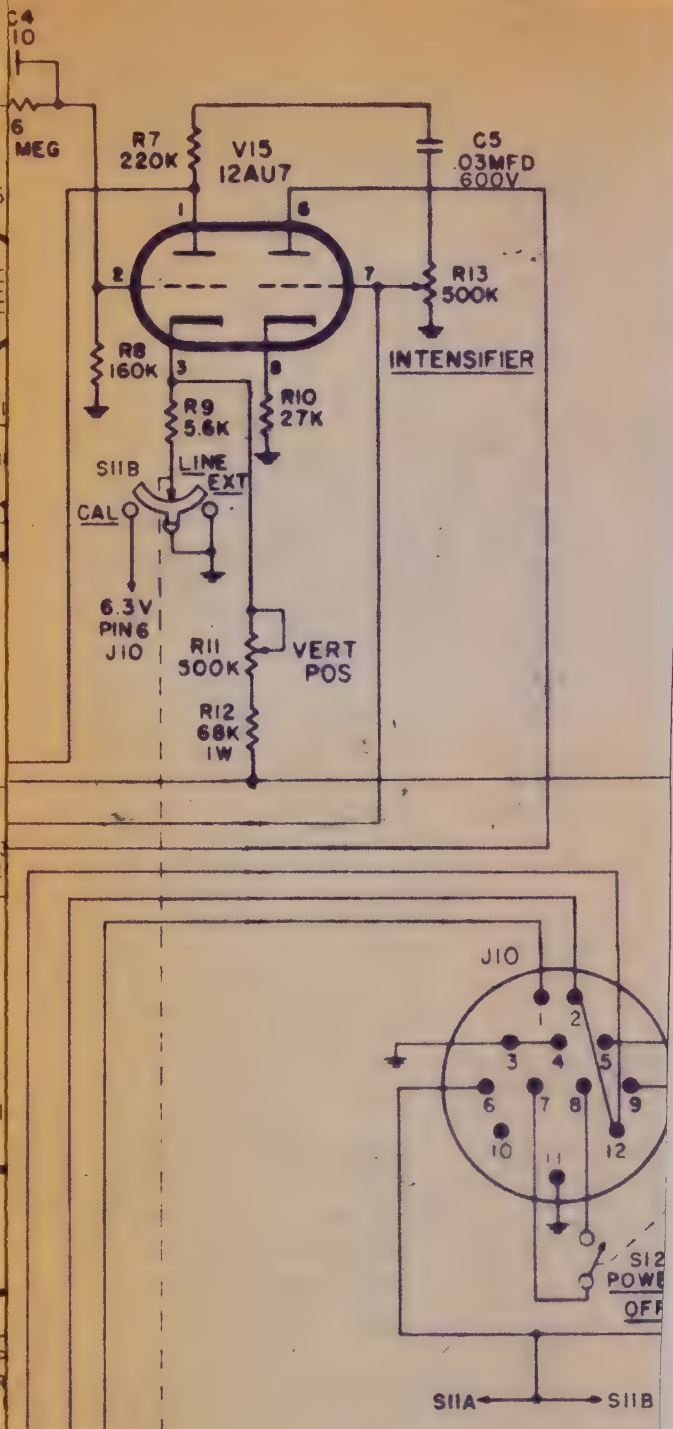


6. Spikes indicating distribution of a pulsed RF signal.

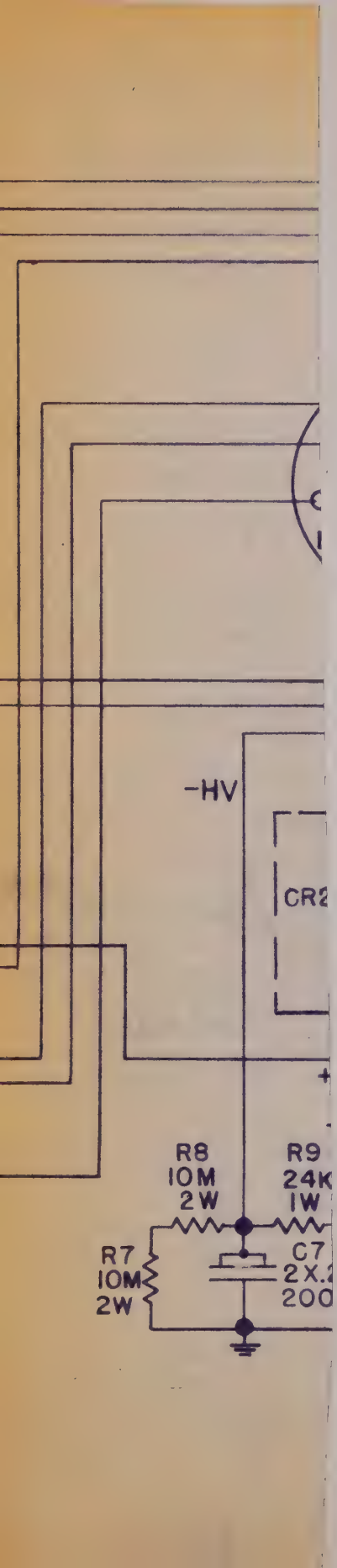
7. Two interfering carriers depicted at maximum sweep width.

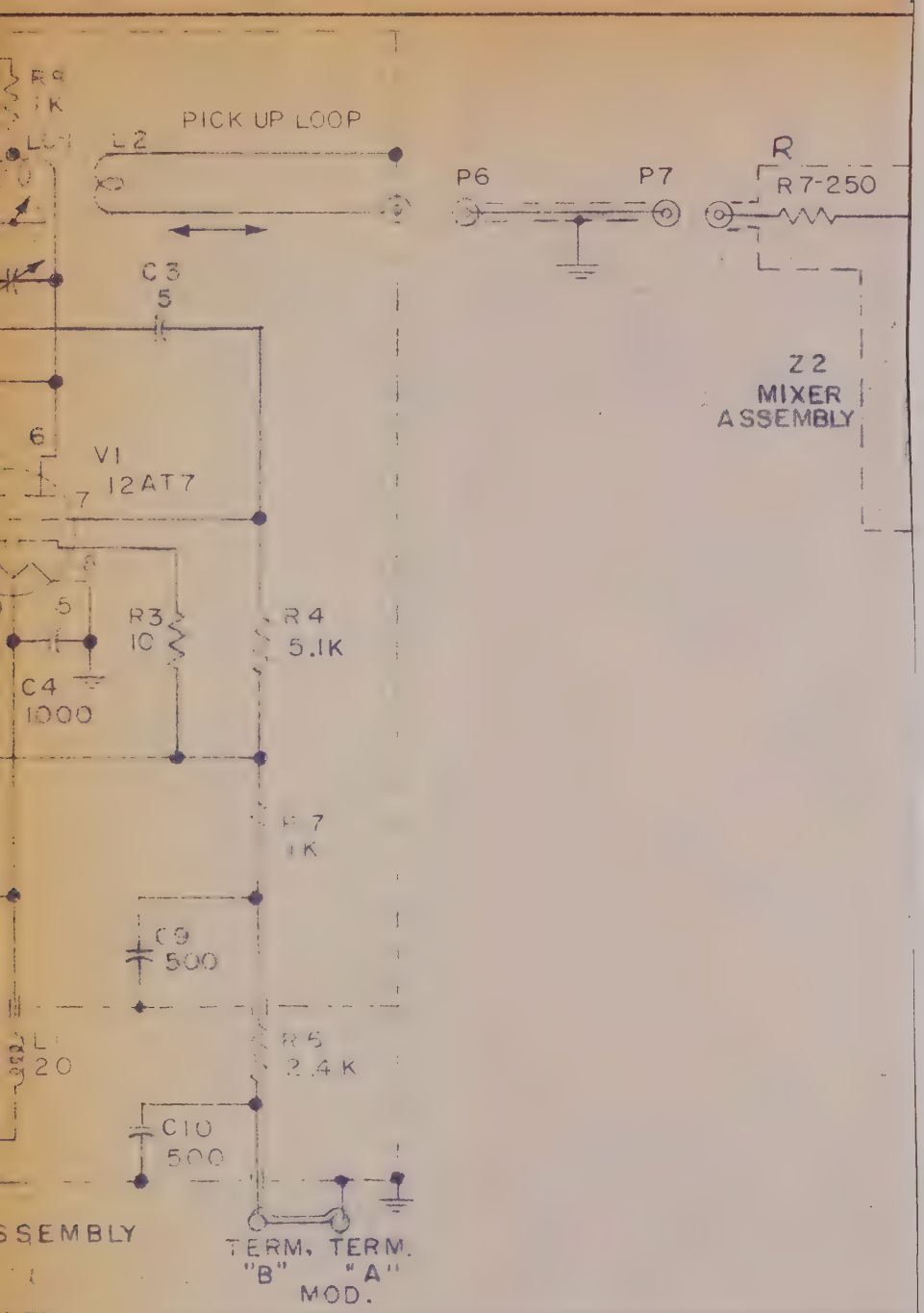
8. Same signals as in 7, sweep width reduced resulting in improved separation or resolution of signals.

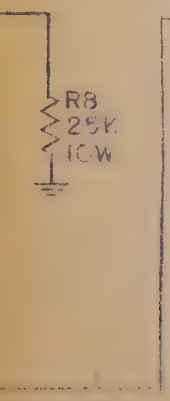
Figure 4: APPEARANCE OF TYPICAL PANORAMIC INDICATIONS



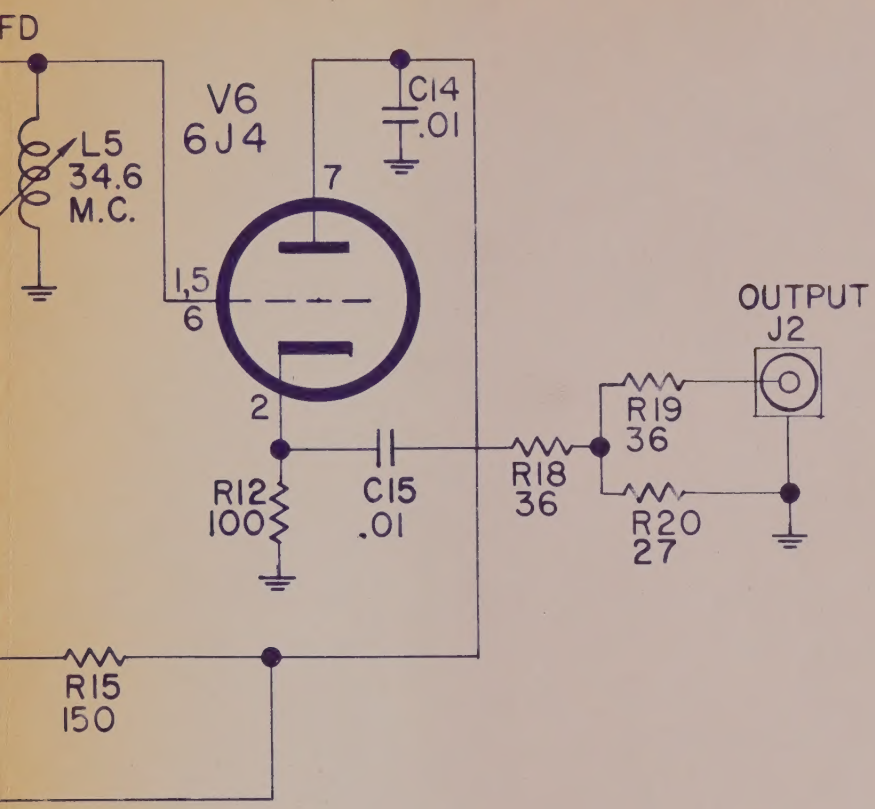
1 ALL RESISTORS ARE 1/2 WATT U
2 ALL CAPACITORS ARE IN MMFD UN
3 UNDERLINED TITLES APPEAR ON
4 * INDICATES FACTORY ADJUST


-HV
CR2
R8
10M
2W
R9
24K
1W
R7
10M
2W
C7





DRAFTSMAN	PF	12/22/54	A	A 5
	✓	—		USED
	LD			SPA-1
MECH.	✓	—		
	TKL	1/19/55		
SPEC.	✓			
ENG.	OF	1/19/55		



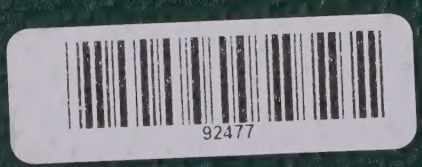
ORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.
TORS ARE IN MFD UNLESS OTHERWISE SPECIFIED.
TORS ARE RATED AT 500V UNLESS OTHERWISE SPECIFIED.

PRA-1

Pre-Amplifier

AS ICL SO #2777 HR 6/12/55 TRG 4/19/55

DRAFTSMAN	HR	4/20/55	PANORAMIC RADIO PRODUCTS INC. MT. VERNON, N.Y.
CHECKER	CF	4/26/55	
ORIGINATOR	TRG	7/20/55	SCHEMATIC DIAGRAM OF
APPROVED MECH.			
APPROVED ELECT.	TRG	4/26/55	PRA-1
APPROVED SPEC.			
APPROVED ENG.	OF	4/26/55	DRAWING NUMBER P4-15051 — REVISION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